This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

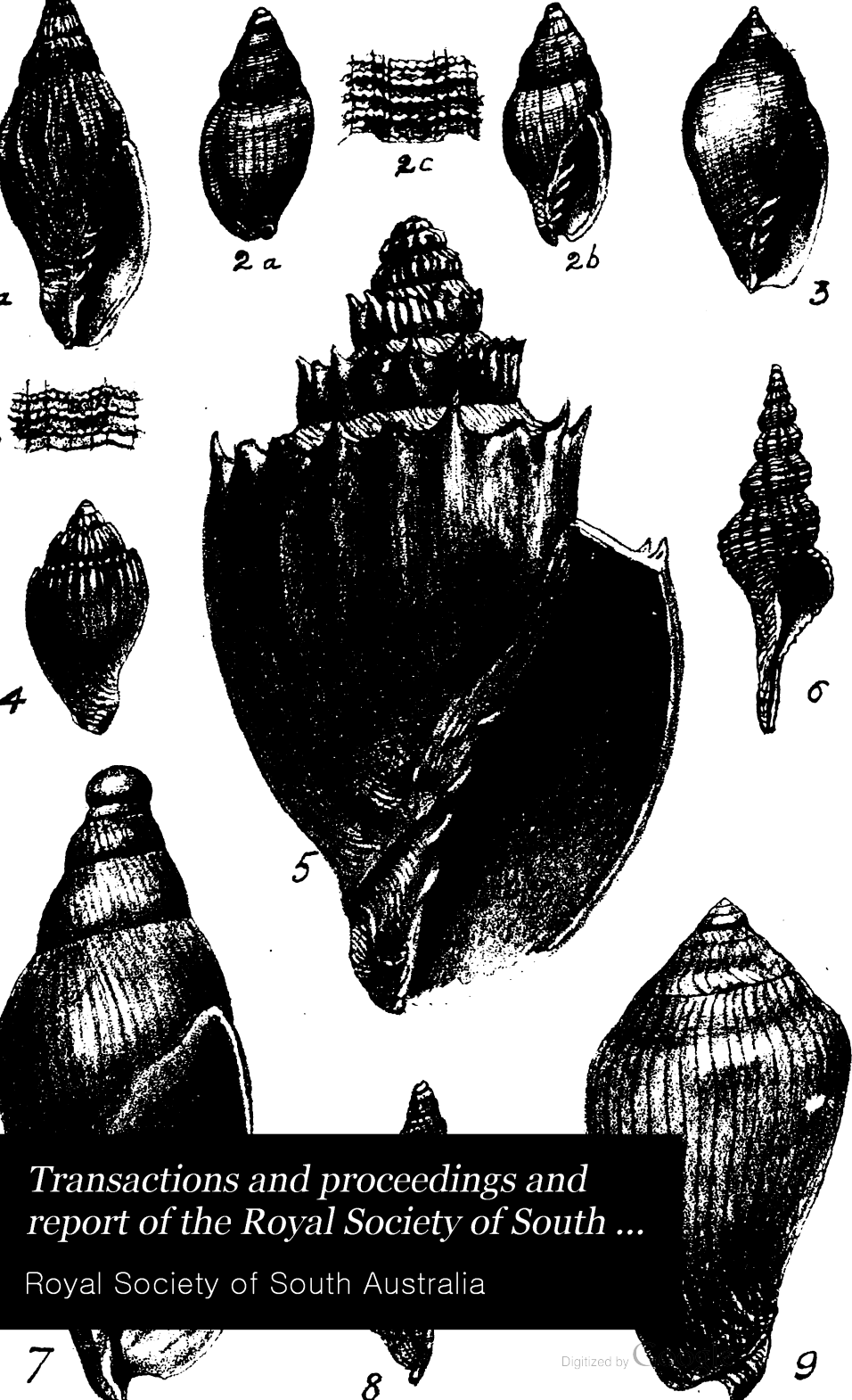
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`



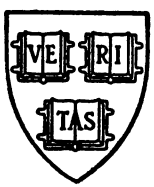
Transactions and proceedings and report of the Royal Society of South ...

Royal Society of South Australia

Digitized by

R04
6600

HARVARD UNIVERSITY



LIBRARY

OF THE

Museum of Comparative Zoölogy

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

APR 10 1916

7256

TRANSACTIONS AND PROCEEDINGS

AND

REPORT

OF THE

ROYAL SOCIETY of SOUTH AUSTRALIA.

VOL. XI.

(For 1887-8.)

PRICE, TEN SHILLINGS.

Adelaide:
W. C. RIGBY, 74, KING WILLIAM STREET.

APRIL, 1889.

Parcels for transmission to the Royal Society of South Australia, from Europe and America, should be addressed "per W. C. Rigby, care Messrs. Thos. Meadows & Co., 35, Milk Street, Cheapside, London."

VARDON & PRITCHARD, PRINTERS, GRESHAM STREET, ADELAIDE.

Digitized by Google

Digitized by Google

APR 10 1916

TRANSACTIONS AND PROCEEDINGS

AND

REPORT

OF THE

ROYAL SOCIETY of SOUTH AUSTRALIA.

VOL. XI.

(For 1887-8.)

PRICE, TEN SHILLINGS.

Adelaide:
W. C. RIGBY, 74, KING WILLIAM STREET.

APRIL, 1889.

Parcels for transmission to the Royal Society of South Australia, from Europe and America, should be addressed "per W. C. Rigby, care Messrs. Thos. Meadows & Co., 35, Milk Street, Cheapside, London."

Digitized by Google

Royal Society of South Australia.

Patron:

HER MAJESTY THE QUEEN.

Vice-Patron:

HIS EXCELLENCY SIR WILLIAM ROBINSON, K.C.M.G., C.B., &c.

OFFICERS.

[Elected October 2, 1888.]

President:

PROFESSOR RENNIE, D.Sc., F.C.S.

Vice-Presidents:

H. T. WHITTELL, ESQ., M.D., F.R.M.S.
E. L. STIRLING, ESQ., M.A., M.D., F.R.C.S.

Hon. Treasurer.

WALTER RUTT, ESQ., C.E.

Hon. Secretary.

W. L. CLELAND, ESQ., M.B.

Members of Council:

PROFESSOR R. TATE, F.G.S. (Representative Governor.)
C. TODD, ESQ., C.M.G., M.A.
D. B. ADAMSON, ESQ.
W. B. POOLE, ESQ.
W. HOWCHIN, ESQ., F.G.S. (Editor.)
REV. THOS. BLACKBURN, B.A.

Assistant Secretary:

MR. A. MOLINEUX.

Digitized by Google

CONTENTS.

PAGE.

DR. JAMES JAMIESON: Drainage of Adelaide and its Influence on the Death-Rate - - - - - - - - - - 1

DR. H. WHITTELL: Effect of Deep Drainage on the Rate of Mortality in Adelaide and Suburbs - - - - - - - 9

PROF. E. H. RENNIE: On Some So-called South Australian Rubies - 17

THOMAS PARKER: An Automatic River Guage - - - - 19

DR. E. C. STIRLING: Preliminary Notes on a New Australian Mammal 21

J. G. O. TEPPER: Surface Features and Rocks of Nuriootpa - - 25

JOHN DENNANT: On the Muddy Creek Beds (plate i.) - - - 30

PROF. R. TATE: New Species of Marine Mollusca from South Australia and Victoria (plate xi.) - - - - - - - 60

PROF. R. TATE: Supplementary List of the Lamellibranch and Palliobranch Mollusca of South Anstralia - - - - - 67

PROF. R. TATE: A Census of the Molluscan Fauna of Australia- - 70

PROF. R. TATE: Additions to the Flora of the Port Lincoln District, with Description of two New Species - - - - - 82

PROF. R. TATE: Plants of the Lake Eyre Basin - - - 85

W. M. MASKELL: New South Australian Coccidæ (plates xii. to xiv.) - 101

D. B. ADAMSON: On Measuring the Power of Telescopic Eypieces - 112

PROF. R. TATE: The Gastropods of the Older Tertiary of Australia Part II. (plates ii. to x.) - - - - - - - 116

REV. T. BLACKBURN: Descriptions of New Species of Australian Coleoptera - - - - - - - - - 175

WALTER HOWCHIN: On the Occurence of Coal Detritus in the Valley of the Murray - - - - - - - - - 215

DR. M. C. COOKE: List of Fungi collected near Lake Bonney - - 217

Digitized by Google

PAGE.

Abstract of Proceedings - - - - - - - 218

Annual Report - - - . - - - . 222

President's Address - - - - - - - 225

Balance-Sheet - - . - - - - - 235

Donations to the Library - - - - - . - 236

List of Fellows and Members - - - - - - 243

Report of the Field Naturalists' Section - - - - - 246

Report of the Microscopical Section - - - - - 249

Digitized by Google

The Drainage of Adelaide and its Influence on the Death-Rate.

By James Jamieson, M.D., Health Officer, City of Melbourne.

[Read November 1st, 1887.]

In the course of a recent visit to Adelaide I was greatly impressed by the evidence of cleanliness everywhere and the freedom from smells. The system of drainage adopted appeared to be excellent in its workings, and I was anxious to discover what had been the effect on the public health resulting from its introduction. Accordingly I obtained, by the courtesy of Dr. Whittell, the Registrar-General, a set of the annual reports on the vital statistics of South Australia for the years 1882 to 1886, embracing the period just before and that just following the completion of the deep drainage system.

At the first glance it appears as if the result, in reduction of the death-rate, had been very marked. According to the reports the death-rate for Adelaide and suburbs, which had averaged 21·38 per 1,000 in the ten years 1875-84, and had never been less than 19·71 (in 1877), fell suddenly in 1885 to 14·34, and in 1886 to 14·31. Such an extraordinary reduction in the rate of mortality, suddenly produced, is probably unprecedented in the sanitary history of any city or town of similar population, and is calculated to excite suspicion that some fallacy has been allowed to creep in. The possibility of error is, of course, admitted by the Registrar-General, who says (Report for 1886): "The peculiar circumstances of the colony during the last two or three years have caused fluctuations in different districts and towns, which may lead to some error in the estimates, which cannot be adjusted till a new census has been taken."

The probability of error, suggested by the very fact of the death-rate having fallen to such an extent, is confirmed by the circumstance that in the same years (1885 and 1886) there was likewise an almost equal lowering in the birth-rate. Now, to whatever cause this may have been due, it cannot be supposed to have resulted from the sanitary improvements, to which a reduction in the death-rate might be ascribed. As regards the lowered birth-rate there can hardly be doubt that its cause is to be found in the commercial depression which has for some time existed in South Australia, and which has probably affected chiefly and most severely the capital.

Digitized by Google

It may be assumed as certain that there has been some drifting of population from Adelaide and its suburbs. But as the Registrar-General had no data enabling him to determine how great had been the loss of population so produced, he was compelled to follow the usual course in framing his estimates year by year. The population of the city and suburbs is thus represented as having increased from 103,864 in 1881, the census year, to 128,377 in 1886. It is more than probable that there has been no such increase, and I venture to suggest a means of calculating, with an approximation to accuracy, what the actual population numbered in 1885 and 1886. The calculation is based on the assumption that the birth rate is nearly a fixed quantity from year to year, and, as a matter of fact, the fluctuation between 1881 and 1884 was only from 42·17 to 42·89 per 1,000 of the population. The sudden fall to 33·61 per 1,000 in 1885, and to 28·24 in 1886 can hardly, therefore, be taken as correctly representing the true condition. It is true that hard times may lead to a lowering of the birth rate, in part directly, though chiefly by lessening the number of marriages; but such an effect is not likely to be so rapid or so marked in Australia as in countries less favourably situated. Without claiming absolute accuracy for the calculations here presented, I venture nevertheless to insist that they offer a nearer approach to the true numbers than official estimates. Taking the population and the number of births in 1881 as showing the true proportion, and assuming that there was a similar proportion existing in 1885 and 1886, a simple rule of three calculation gives the following results. The births in 1881, to the number of 4,424, corresponded to a population of 103,864, and therefore 4,270 births in 1885, and 3,626 births in 1886 may be taken as representing a population of 100,248 in 1885, and 85,129 in 1886. And having obtained an approximately correct population basis we are in a position to calculate, with a similar approximation to accuracy, the true death rate in the same years, viz., 18·17 per 1,000 in 1885, and 21·59 per 1,000 in 1886. If the two years are taken together, to eliminate accidental variations, the rate is found to have averaged 19·74, or rather less than the average of the three previous years, 1882-84, which was 21·11, and almost the same as the most favourable of the ten previous years, viz., 1877, with a rate of 19·71.

While it seems probable, therefore, that there has been some reduction in the death-rate in 1885 and in 1886, it must also be regarded as certain that the reduction has not been nearly so great as is shown in the official estimates.

But the influence of sanitary improvements on the health of the population may be shown in a different way. There are cer-

Digitized by Google

tain diseases whose prevalence and fatality are generally taken as safe tests of the sanitary condition of a town or district, and in particular of the purity of the water supply and the completeness and perfection of the drainage system. They may be dependent, in greater or less degree, on other conditions; but the mortality caused by them may be expected to vary with those just mentioned. The diseases which may be regarded as dependent for the degree of their prevalence, more than almost any others, on the sanitary condition of a district are typhoid fever and the group known as the diarrhœal diseases. Bad drainage, filthy surroundings, and saturation of the soil with foul water are generally regarded as favouring their occurrence, while the opposite conditions, in similar degree, tend to limit their prevalence, other things being equal. Now, in Adelaide I do not understand that there has been any material change in the water supply of late years, and a marked diminution in the fatality from the diseases named may, if found, be fairly put to the credit of the improved drainage. I have endeavoured to make a comparison of the mortality returns of the last few years, with the view of discovering whether or not this has been actually the case. For that purpose, however, it has been necessary to adopt a different basis from that supplied by the total area described as *Adelaide and suburbs*, since, though the deaths are given according to the registration districts in which they occurred, it is not possible to make out what the districts are which go to make up that area. It has been necessary, therefore, to have recourse, for purposes of comparison, to the registration district of Adelaide, which seems to be wider in extent than the city of Adelaide, though smaller than the full metropolitan area described as Adelaide and suburbs. This arrangement is, I venture to suggest, a little confusing to those who consult the annual reports without possessing the advantage of local knowledge. Still, it is possible to make a comparison of the mortality for a series of years in the same district and that corresponding closely with the area which has been efficiently provided with sewers. The following table shows the total mortality in the Adelaide registration district for each of the years 1882-86, with the deaths in the same years from typhoid and from diarrhœa, dysentery, and cholera :—

	Total deaths.	Deaths from Typhoid.	Deaths from Diarrhœal Diseases.
1882.	1,752	82	174
1883.	1,604	62	176
1884.	1,710	68	179
1885.	1,332	46	124
1886.	1,380	40	76

It is unnecessary to discuss again whether the reduction in the

Digitized by Google

total number of deaths is in itself a proof that the mortality-rate has been lowered in the last two years; I wish rather to point out the fact that there has been a marked reduction, both absolutely and relatively, in the mortality from the diseases selected for consideration. While in the three years 1882-84 the deaths from typhoid amounted to 4.18 per cent. of the whole, they formed only 3·17 per cent. of the total mortality in 1885-86. Again, in 1882-84 the diarrhœal diseases were responsible for 10·44 per cent. of the total mortality, while in 1885-86 that percentage was only 7·37.

These figures appear to show very satisfactory results, but it is necessary to admit that they may fairly be subjected to criticism before being accepted as proof of the benefits following sanitary improvements. It may be alleged with reference to the lowered death-rate from typhoid that it is simply due to the fluctuations observed to occur in the prevalence of this disease. And with reference to the diminution in the number of deaths from the diarrhœal class of diseases, it may be insisted that the reduction is the consequence of the lowered birth-rate, most of the deaths from these diseases occurring among infants.

These criticisms are fair, and must therefore be fairly met, and that which applies to the lowered mortality from typhoid can, I think, be fully met, though it must be admitted that the figures referring to the diarrhœal death-rate cannot be taken as very conclusive evidence. The general validity of the conclusions may be tested in the following way:—If the lessened mortality in 1885-86 was simply owing to accidental fluctuations, the result of seasonal or other influences not clearly ascertained, then there ought to have been a somewhat similar range of fluctuation in other districts. For the purpose of discovering whether or not this was the case, I have constructed the following table, the figures in which apply to the whole of South Australia, exclusive of the registration district of Adelaide.

	Total deaths.	Deaths from Typhoid.	Deaths from Diarrhœal Diseases.
1882	2,641	64	308
1883	2,831	73	305
1884	3,079	66	259
1885	2,655	86	210
1886	2,654	53	252

When rates are calculated, as before, it appears that, while typhoid caused 2·37 per cent. of the total mortality in 1882-84, the percentage was 2·52 in 1885-86. In the two periods the percentage of the general death rate from the diarrhœal diseases was 10·19 and 8·38 respectively.

Digitized by Google

The rates for each of the districts compared may be thrown into a table thus—

	Percentage of deaths from Typhoid.		Percentage of deaths from Diarrhœal Diseases.	
	1882-84	1885-86	1882-84	1885-86
Adelaide District ...	4·18	3·17	10·44	7·37
Rest of S. Australia ...	2·37	2·52	10·19	8·38

I am not inclined to lay stress on the reduction in the relative death rate from the diarrhœal diseases, since there was a reduction in both districts, and to an extent somewhat proportional to the lessened number of births. But the figures referring to typhoid cannot admit of any explanation applying to both. Though the mortality from typhoid is, on the average, greater in Adelaide than in other parts of the colony, there has been in the former a reduction of about one-fourth, while in the latter there has been a slight increase in the second period, 1885-86. If climatic, or any other general conditions, had been the cause of the lowered rate of mortality from typhoid in Adelaide, it is difficult to see why they should not have shown their effect, at least to some extent in a similar way, in other parts of the colony. The presumption rather is that the true cause of the lessened death rate in Adelaide has been the improvement in the drainage system.

If, therefore, there has been a distinct, if not very great reduction in the general rate of mortality, and a marked reduction in that resulting from typhoid—the disease above all others amenable to the influence of sanitary improvements—it is a fair inference that these improvements have had the effect which might reasonably have been anticipated. Further experience may be needed to make this conclusion incontrovertible, but the proof is sufficiently strong to encourage the authorities in other cities and towns to follow the example of Adelaide. My hope is that it may strengthen the hands of those who are endeavouring to obtain for Melbourne a similar boon, since I have long been persuaded, and often declared, that it is chiefly from the adoption of a proper system of drainage that we can expect to have a decided check given to the prevalence of typhoid, which has for many years been a constant scourge.

In conclusion, may I venture to suggest that it is the duty of the Government of South Australia to have such a census taken of the population of Adelaide as will allow of an accurate calculation of the death-rate, so that we may not be in uncertainty whether or not the system of drainage recently adopted has actually lowered the death-rate of the city to an extent at all approaching that brought out in the official reports. The expense need not be great, and the matter is one of no small importance, and should not be waited for till 1891, the regular census year.

Digitized by Google

Supplemental Remarks.

[Read December 6th, 1887.]

Many thanks for your [Dr. Whittell's] courtesy in sending me an analysis of the paper which you have prepared for the next meeting of the Royal Society. I do not know that it is possible for me to add much to what was said in my paper, though I am sufficiently well aware of its imperfections, and indeed confessed to a liability to error from want of local knowledge. I was not long in Adelaide, on the occasion of my recent visit, till I heard the claim made that it is not only the cleanest but the healthiest city in Australasia, the mortality being as low as about 14 per 1,000. I could not help the suspicion that there was a fallacy somewhere, and, as you know, had begun collecting information before I left Adelaide to return home. By your kindness I obtained a set of the returns of the vital statistics of South Australia for a few years back, and proceeded to analyse these with the hope that something useful might result.

So far as I can judge from the rather incomplete newspaper report of the discussion which followed the reading of my paper, there had scarcely been sufficient heed given to the saving clauses which it contained.

The first part of the paper was taken up with an endeavour to arrive at some conclusion about the nature and extent of the fallacy which I supposed to exist in the estimate given in the annual report of the Registrar-General, that the death rate of Adelaide and suburbs had been only 14·34 in 1885, and 14·31 in 1886. The first and most natural supposition was that the population had somehow been over estimated, and this was confirmed by the circumstance that the calculated birth rate had come down in about the same proportion as the death rate. Both reductions would meet with their explanation on the supposition of an over estimate of the population; while sanitary improvements, capable of lowering the death rate, could scarcely be supposed to influence the birth rate unfavourably and in about equal degree. The number of the population must always be to some extent uncertain at periods remote from the previous census year, and, as was very distinctly brought out at the census of 1881, there is always a special liability to over estimate the number. Then there was the undoubted fact that South Australia had been passing through a period of serious depression, leading to an excess of departures over arrivals. The number of persons leaving by sea cannot be known with certainty, and there can be little accurate information about those crossing the border.

Without claiming absolute accuracy for its results, I believed that by taking the number of births as a fixed basis, it would be

Digitized by Google

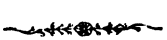
possible to reckon back to the true population rate. I admitted the fallacies to which the method was liable; but, failing a proper census, I do not know of any other method of checking the results obtained by adding to the population of the previous year the births and deducting the deaths.

I was aware that the deep sewer system had not been extended to the whole area embracing Adelaide and suburbs, and the discussion, as to the population and death rate, was purely of a technical kind; it was for the statistician, pure and simple, and not for the practical sanitarian. When the inquiry came actually to be as to the probable influence of the drainage system on the public health, it was necessary to limit it as closely as possible to the population within the drained area. I knew that the whole of the *City of Adelaide* had been drained, but the detailed returns of causes of death were not given for the city separately, and if the inquiry was to be continued at all, I had no choice but to take the returns for the *registration district of Adelaide*. I had no means of knowing the area of that district; and though it was apparent that its population was greater than that of the city, it was also certain that the city population formed the large majority. It was a fair assumption that any cause (*e.g.*, drainage) which affected to an appreciable extent the health of the large majority would make that effect to be seen in the total. Clearly there were fresh possibilities of error introduced; but I could only use the figures at my disposal, and these were for the *Adelaide registration district*. I would not have been so much inclined to place confidence in the reduced mortality from typhoid in that district in 1885-86, as tending to show the beneficial influence of the drainage, but for the fact that there had been no similar reduction in other districts of South Australia, rather a slight increase, as shown in table of my paper. Though the proportion of deaths from diarrhœal diseases had also been reduced, I did not feel warranted in laying much stress on that circumstance, as it was capable of explanation in another way, viz., the smaller number of infants, who supply the chief victims of these diseases.

But it may be said, if the subject was surrounded with such difficulties, and if the conclusions arrived at had to be so carefully guarded by saving clauses, why did I meddle it all? In reply, I can only plead that the subject was a very interesting and important one. If further put on my defence, I would have to say that in the first instance the question was not raised by me, the claim being openly made that the mortality in Adelaide had been reduced to about 14 per 1,000, as a result of the adoption of the drainage system. But, after all, it must be admitted that I had another object in view. Here, in Melbourne, we are in the

Digitized by Google

throes of discussion as to the desirability of forming a Metropolitan Board of Works, with power to take in charge the drainage of the city and suburbs, and I was anxious to find whether evidence of a reliable kind could be obtained from your experience which could be adduced in support of that measure. As the discussion could best be followed up by the members of your Royal Society, I ventured to bring the paper before them, and I am gratified to learn that my endeavour, which was at least well meant, had been met in such a friendly spirit.



Digitized by Google

On the Effect of Deep Drainage on the Rate of Mortality in Adelaide and Suburbs.

By H. Whittell, M.D.

[Read December 6th, 1887.]

At the last meeting of the Society a paper by Dr. Jamieson was read on the effects of deep drainage on the mortality of Adelaide and suburbs. On that occasion I made some comments which the Council has been good enough to request me to reduce to writing, with a view to their being read at this meeting as an introduction to a discussion which it is believed will be of interest to most members of the Society.

It will be remembered that in dealing with his subject Dr. Jamieson adopted two methods of investigation.

First—He compared the returns from the Registration Office of the population and deaths in Adelaide and suburbs during periods just before and just following the completion of the drainage.

Second—He drew a comparison of the mortality from special forms of disease (typhoid fever and diarrhœal diseases) with the mortality from other diseases occurring during the same periods in the registration district of Adelaide.

The conclusions, on the whole, were favourable to the system of deep drainage, and those of us who advocate the extension of the system might accept them without comment, if it were not that our silence might be misconstrued, and leave us open to the charge of accepting a favourable conclusion, although we know that the premises are incorrect. I have examined the doctor's figures with some care, and although I am at one with him in his conclusions, I cannot accept his calculations as having any important bearing on the subject of discussion. In saying this I wish it to be understood that I have a high appreciation of Dr. Jamieson's qualifications for the task he undertook, and also of the neighbourly interest he has manifested in his endeavour to assist us in determining a question which is of some importance to the whole of the Australian colonies. The errors into which the doctor has fallen are due to a want of knowledge of our localities, and to no other cause.

Referring to the first series of figures, in which the ratios of mortality in Adelaide and suburbs are compared during periods

Digitized by Google

just before and just following the completion of the deep drainage, the doctor says that he finds a sudden fall from an average during the old system of 21·38 per 1,000 population to 14·34 in 1885 and 14·31 in 1886, the latter two being the years since the new system was completed. The doctor questions the accuracy of these figures, and gives reasons for the inference that the official estimate of population for the last two years is incorrect. By a method of calculation explained in his paper he arrives at the conclusion that the population of Adelaide and suburbs was over-estimated to the extent of about 26,700 in 1885 and of 43,100 in 1886, or in other words, that when compared with 1884 Adelaide and suburbs lost in 1885 as many as 23,290 of its population, and in 1886 a further number of 15,019, making in two years a loss of about 38,300—*i.e.*, nearly one-third of the estimated population for 1884. I need but remind you that if a population be over-estimated the rate of mortality per 1,000 will appear to be less than it really is, and the locality will stand out as better from a sanitary point of view than places where the estimate is more correctly made. Having satisfied himself that Adelaide and suburbs is over-estimated, and having worked out other figures for himself, Dr. Jamieson calculates the rate of mortality on the basis of his new figures, and he arrives at the conclusion that according to his first mode of comparison the deep drainge has produced some slight diminution in the rate of mortality. I leave the question of population for the present because, although important, it need not be discussed in connection with the objection I have to make against any conclusions either for or against deep drainage being drawn from the doctor's calculations. The fundamental error into which Dr. Jamieson has fallen is the assumption that the drainage area and the area of Adelaide and suburbs are co-extensive. In 1885 and '86 the only places served by deep drainage were Adelaide, Hindmarsh, and Thebarton. "Adelaide and suburbs," as explained in the Registrar's report for 1886, means Adelaide and places within a radius of ten miles of it. This area includes Adelaide, Hindmarsh, and Thebarton, but it also includes Port Adelaide, Norwood, Kensington, Unley, Goodwood, St. Peters, Mitcham, Burnside, Glenelg, Semaphore, Crafers, Prospect, and other smaller towns, none of which, except a small part of St. Peters and Kent Town is connected with the deep drainage. The population of Adelaide and suburbs in 1884 may be set down in round numbers at 123,500; that of the drained part was about 52,300. It is therefore obvious that any calculations on the effect of drainage based on the returns for Adelaide and suburbs can only be inconclusive and misleading. I fear that the Registration Office must take some part of the blame for Dr. Jamieson's mistake. The published returns were

Digitized by Google

clear enough for South Australians, but the distinction between Adelaide and suburbs was not sufficiently marked for strangers. I noticed this a few months ago, and in the last three quarterly reports the form of the return has been altered so that no further error can occur.

Coming on to Dr. Jamieson's second mode of calculation, that in which a comparison is drawn between the mortality from typhoid fever and diarrhœal diseases and the mortality from other diseases occurring in the same period, I agree that such a comparison is fair and legitimate, and in the absence of disturbing factors the conclusions drawn from it afford a fair indication of the sanitary condition of localities to which the test is applied. A glance at the figures shows that the doctor has spent much valuable time in the preparation of this part of his paper. In the comparison he now undertakes he discards the Adelaide and suburban population because, as he explains, he could find no guide to enable him to make out what registration districts are in the Adelaide and suburban area. He therefore falls back on the registration district of Adelaide, which he supposes to correspond closely with the area efficiently provided with sewers. I regret that want of local knowledge has again led the doctor into fatal mistakes. Registration districts are arbitrary divisions of the colony made for the purpose of affording facilities for registration, and without reference to any other requirement. Once formed, they cannot be altered without introducing confusion and probably mistakes into official records. The Adelaide registration district has no relation to the drainage area. It includes Adelaide, Parkside, Unley, Mitcham, Mount Lofty, Belair, Brighton, Reedbeds, Salisbury, Stirling East, Walkerville, Glen Osmond, Dry Creek, Plympton, and many little townships scattered around the places I have named. Adelaide is the only town in the district that is within the drainage area. The other drained towns—Hindmarsh and Thebarton—are not included. The objections to the doctor's first series of calculations tells therefore with even greater force against the second, and I believe that if we could have the pleasure of Dr. Jamieson's attendance he would be the first, after the explanation I have given, to tell us that his figures furnish no guide to the determination of the question he undertook to discuss.

Here I might close my remarks on Dr. Jamieson's paper, but a rather long portion of the contribution is given to a discussion of a subject collateral to the main question but having an indirect bearing upon it. The doctor notes the record of the sudden fall in the ratio of mortality in Adelaide and suburbs from 21·21 per 1,000 in 1884 to 13·34 in 1885 and to 14·31 in 1886, and he endeavours to show by a mode of calculation of his own

Digitized by Google

that there is an error in the official figures, and that the population for the latter years was over estimated. This remarkable fall in the ratios has attracted the notice of others. Mr. Hayter, in publishing the figures in the Victorian Year Book, appended a note suggesting that the area to which the respective figures referred had been altered. This was also the opinion of some gentlemen in Adelaide. Others supposed with Dr. Jamieson that the population was over estimated. I became Registrar-General in 1885, a few months after Mr. Cleland, my predecessor, had calculated and published the estimated population for that year. At the year's end when the ratios were calculated, and this falling off in the rate of mortality became apparent, my first impression was that the population for the year had been set down at too high a rate. Against this I had the knowledge that Mr. Cleland had been familiar with the vital statistics of South Australia from the early times, that his calculations had stood the test of census returns as well as, and perhaps I should be correct if I said much better than, those of the statisticians of other colonies, and that an error on his part was improbable. This did not prevent an investigation. I soon found that Mr. Hayter's surmise was incorrect, there had been no alteration in the area. Two changes had, however, occurred in the early part of 1885, either of which might affect the estimate. The first change was made in the office. Up to the end of 1884 Mr. Cleland published his returns of local population in accordance with the census of 1881, without taking into account any increase or decrease of numbers after the census was taken. This was stated at the head of some of the quarterly returns, but on examining the figures I find the statement was not strictly accurate. That part of the table which referred to Adelaide city was evidently based on an estimated population of the whole area of Adelaide and suburbs, and every one who knows anything about vital statistics will agree that this was a wise and proper change to introduce. He not only did this, but he calculated the back years, and prepared a uniform table of results so as to furnish a means for comparison. This was a delicate operation, in which an error might easily creep in. It was on these new estimates that the ratios for 1885 were cast, and it was in this year that the lessened mortality commented on by Dr. Jamieson was recorded. Since my appointment to the office of Registrar-General Mr. Cleland has explained to me his mode of calculation, and I can only say that after a prolonged examination of such data as were available I could find no error which would have justified me in putting aside the figures which Mr. Cleland had so carefully prepared. In preparing the estimate for 1886 we both agreed that it would not be safe to follow the usual mode

Digitized by Google

of calculation, and a reference to our returns will show that we made only such a trifling addition at the beginning of 1886 as our altered circumstances appeared to warrant. The second change, in 1885, was more important. In that year, for the first time within my knowledge, the emigration from South Australia largely exceeded the immigration, and this continued to be the case during the whole of the following year. In 1885 the excess was 6,581. In 1886 it was 7,927. These were the losses by sea. We have no means of knowing the increase or decrease of population by land, but we shall probably be near the mark if we set down 15,000 as the total loss of the colony during two years by excess of emigration. As a matter of fact we did not suffer a diminution of population, because the excess of births over deaths during those years as nearly as possible balanced our loss. All this was taken into account and dealt with in our estimates for the whole colony; but when we come to the estimation of local populations, our difficulties begin. In hard times there is a constant migration of the people from one place to another. Men travel to any part of the colony when there is a chance of obtaining work, and the estimate of numbers in any one locality can only be regarded as approximate. Until a new census be taken it will be impossible to guarantee a strictly accurate return.

Dr. Jamieson suggests a mode of estimating local population which he thinks would be more reliable than that usually followed. He proposes to make the number of births in a given period the basis for calculation. His method of proceeding from the known to the unknown is this—we know that in the census year there was a certain population, say in Adelaide and suburbs; we know also that in the same year there was a certain number of births. If we want to get an approximate estimate of the population in any future year, we have only to take the births during the year, and assuming there is a fixed relation between the births and population, we can estimate from the births what the population for that year ought to be. In other words, supposing that in the census years it required 24 people to produce one baby, we have only to multiply the births in any other year by 24 and the product will give us a fair estimate of the population. It will occur to you that the accuracy of the result must depend so much on other factors that this mode of calculation cannot be accepted as reliable. We want to know something more about the 24 people. How many of them are children. How many unmarried, and of those that are married how many have the depressed times separated—the wife being left in charge at home while the husband is far away working, or seeking work, to support his family. In a normal steady-going condition of society Dr. Jamieson's method might give fairly accurate results,

Digitized by Google

but in this colony, subject to all sorts of fluctuation, I should be reluctant to adopt it. Let us take the city of Adelaide as a test. In the census year, 1881, the population was in round numbers 38,500; the births were 1,380. Assuming that the births are a safe index, the population fell in 1882 to about 34,000. In the next year, 1883, it bounded up to 39,000. It remained the same in 1884, and in 1885 it fell to 35,000. Those of us who reside in Adelaide know full well that there were no such upward and downward leaps as those indicated. Nothing occurred in 1881 to 1882 to justify the belief that Adelaide lost 4,500 people, nor was there anything in 1882 to 1883 to account for the sudden addition of 5,000.

The question still remains—Have we at present any data to enable us to determine the effect of deep drainage on the public health? I use the words at present advisedly, because I believe we shall have to wait several years before we shall experience the full benefits which our improved system will confer on us. Those who have made Adelaide their home will remember the condition of things. A few years ago Adelaide could properly be described as a city of stinks. There were hundreds of privies with cesspools that were simply holes in the ground, and from these the subsoil was saturated with filth of the most offensive kind. The only escape for house-slops was into the public gutters; and we all remember the abominable pools of filthy liquids which existed from one end of the city to the other. Deep drainage has put an end to these nuisances, but it has not removed from the subsoil the filth which has been accumulating there for years. There is a common idea that earth is the great purifier for excretal matters, and so it is if there be plenty of vegetation to use up the material, but without vegetation the earth soon becomes saturated, and afterwards the changes become so slow that it is difficult to know when the dangers arising from this earth-poisoning will end. Two or three years ago there were some extensive alterations being made at the back of a drapery establishment in Rundle-street. One of these required the excavation of earth for a large underground warehouse. One morning the contractor called at the Board of Health Offices and invited me to go down to this work, where I should find something to interest me. When I went there I found that a long excavation had been made from the back of the Rundle-street shop in a direction towards North-terrace. Just at the back of the shop there had formerly been an old privy, with a cesspool behind it. This had not been used for several months, having been emptied and filled up as required by the Hydraulic Department when connection was made with the sewers. The excavation had brought to view a long wedge-shaped mass of earth below the surface, differing in

Digitized by Google

colour from the rest, several feet thick, just below the old closet, and tapering off towards North-terrace to a thickness of a few inches. The length was 24 feet, and any part of this, even at its apex, when removed had a fecal smell as distinct as though it had just been taken from beneath the cesspool. This was only a section, but the workmen told me that the whole part excavated had a similar layer of stinking earth. I could not learn how long this privy had been in use, but we can readily imagine the filthy condition of our subsoil when we remember that hundreds of similar cesspools have been in use in all parts of the city during some 20 to 30 years. All this pollution has to be paid for, the purification of such soil will be slow, and until it is effected we cannot fairly estimate the advantages of having adopted a cleaner system.

In dealing with figures it is easy to fall into mistakes, and the risk of this is increased when we have to draw conclusions from comparatively low numbers. But after making allowance for this and taking care to give the weight of any doubtful point against rather than in favour of the new system, I believe the experience of Adelaide, so far as it has gone, has been altogether on the side of deep drainage. At the time of the census the population of the city was about one seventh and a half of the whole colony. It is safe to assume that the ratio remained about the same down to 1884, and also that the Registrar's estimate of the city population for that year was correct. After 1884, the year when the city drainage was completed, the loss by excess of emigration, as we have already seen, was for the whole colony 15,000 during two years. The proportionate loss for the city would therefore be 2,000. The excess of births over deaths in Adelaide during this period was 1,077, leaving a net loss of say 1,000, but seeing that it is probable that the proportionate loss by emigration was greater in Adelaide than in other parts of the colony, we will assume that double this number represents the loss that actually occurred. This would reduce the Adelaide population to about 40,600. The Registrar's calculations of the ratio of mortality of Adelaide have been made and published during the last three or four years on two distinct bases. In one the number of deaths occurring in the city is compared with the estimated population. In the other the rate is calculated after excluding all deaths in hospitals and public institutions of patients who have not up to their illness been residents in the city. For our present purpose it is not of much importance which of these calculations we adopt. If we take the latter, the ratio of mortality during two years (1883 and '84) was about 20·4 per 1,000; the ratio for the two years since the deep drains were completed, calculated on the assumption that the population fell to 40,600, was 17·6. If we take the first method the average of the ratios

Digitized by Google

from the census to 1884 was 24·5. In 1885 and '86 the average was 21·5. This is a most welcome diminution. You will have noticed that in drawing this comparison I have not closely followed the official estimates, but have allowed a wide margin for adverse factors. I am not anxious to strain these figures beyond their legitimate use; we want a longer time and larger numbers before we can draw positive conclusions. Meanwhile we may fairly assume that the abatement of city nuisances, the speedy removal of filth from our premises, and the blessing of pure air, have produced the beneficial results we are entitled to expect from them, and that a large part of the remarkable reduction of mortality in Adelaide is due to the completion of our new system of drainage.

Digitized by Google

On some so-called South Australian Rubies.

By Professor E. H. Rennie, D.Sc.

[Read May 1st, 1888.]

As is well known, considerable controversy has arisen in Adelaide as to the nature of the red stones recently found in large quantities in the northern interior of South Australia, some stating that these stones are genuine rubies, others that they are spinelles, others that they are garnets, while others still imagine that they are something quite new. The latter notion has arisen chiefly, I think, from statements made that they are infusible and harder than garnets, though scarcely hard enough for rubies. It has often occurred to me that it is somewhat strange that so far no results of any chemical examination of these stones have been published, such an examination being, in my opinion, *the* crucial test of their nature. By the courtesy of various gentlemen some of these stones from three of the Companies, viz., McDonnell Ranges, Hale River, and Maude, have lately been placed at my disposal. Before stating the results obtained it may be well to state briefly the nature of the various minerals above alluded to, viz., rubies, spinelles, and garnets, and to show that they differ widely from one another in chemical composition.

1. *Rubies.*—These consist essentially of alumina, but there may be present small quantities of impurities, especially magnesia and silica.

2. *Spinelles.*—These consist essentially of an aluminate of magnesia, but there may be present, according to Dana, from about $1\frac{1}{4}$ to $5\frac{1}{2}$ per cent. of silica, with occasionally considerable quantities of lime and oxide of iron.

3. *Garnets.*—These vary greatly in composition, but are in all cases silicates. I have only been able to find two cases in which the silica is below 35 per cent., and in those cases the percentages are about 34 and 31 respectively. They may be silicates of lime and alumina, of iron and alumina, of magnesia and alumina, of manganese and alumina, of lime and iron, of lime and chromium, with varying small quantities of other constituents.

To come now to the results of analysis. All the specimens I have examined have proved to be silicates of alumina and iron, with small quantities of oxide of manganese, lime, and magnesia, and hence are undoubtedly garnets, as Mr. Streeter says, "of the Almandine variety." The following are the quantitative results obtained by the analysis of some of the stones from the Hale River:—

Digitized by Google

Silica (SiO_2)	38·48	per cent.
Alumina (Al_2O_3)	27·09	"
Ferrous oxide (FeO.)	26·28	"
Lime (CaO)	1·99	"
Magnesia (MgO)	4·20	"
Oxide of manganese (MnO) ...	·35	"
	98·39	

In this analysis all the iron has been reckoned as protoxide; in all probability some is present as peroxide, and this would account for the low total. Another sample from the Maude Company yielded 39 per cent. of silica, with large quantities of alumina and oxide of iron, and smaller quantities of lime and magnesia.

A word or two now with reference to hardness and infusibility. First, with reference to hardness. Unfortunately I have no reliable specimens at hand with which to test hardness; but let us take for granted that the hardness of some of these stones is 8, and that is, I understand, the highest that has been given. Dana, one of the greatest, if not the greatest, mineralogical authority, places the hardness of garnets at from 6·5 to 7·5. Between the latter number and 8 there is a very small margin, and no one with any knowledge of the great difference in physical properties produced by comparatively small variations in chemical composition will lay any stress upon this small excess of hardness. In connection with this it may be noted that the analyses above given show rather larger proportions of alumina and less of oxide of iron than are contained in most of the specimens of this variety of garnet, analyses of which are given by Dana, the silica being about the same. It is quite possible that this slight difference in composition may account for the increased hardness. Then as to alleged infusibility. Very much depends upon the method of testing. These stones will not fuse if they be tested by the blowpipe as they are found, but let them be powdered first, and the powder fuses easily into distinct globules. This will never happen with true rubies or spinelles.

In conclusion, it must be understood that my statements relate only to those specimens handed to me, which, however, I am assured are representatives of the vast majority of stones sent to Europe. It would be rash to say that no rubies have been found. Further, I have brought this matter before the Society simply as of some little scientific interest, and my remarks must not be taken as having any reference to the value of these stones. What they are worth from a commercial point of view I cannot say; it may be much or it may be little.

Digitized by Google

An Automatic River Gauge.

By Thomas Parker, C.E.

[Read July 3rd, 1888.]

Since the reading of my paper on "Underground Waters" before the Society last year, in which I drew attention to the great need of a systematic gauging of the rivers and streams of this colony, I am glad to learn that the Government have given instructions for this work to be undertaken.

During the course of my labours in gauging one of our rivers by the usual method, I was led to attempt some improvements on the existing system of taking such observations, and as a result, have designed an automatic river gauge. My object in this paper is to give a description of the invention, the method of using it, and also point out what I think are its advantages in point of economy and efficiency.

I will first briefly describe the present methods of gauging rivers.

The usual methods of gauging rivers are—(1) By current meter, and (2) by a weir and graduated scale. The first method is that generally used for large rivers where a weir does not exist or is not easily erected. It is now being used by the various colonies in gauging the River Murray. It is a portable instrument, and so constructed that on being dipped in the stream the working parts are caused to revolve by the flow of the water, and the velocity of the river flow is indicated by the number of revolutions made and indicated by the instrument. This velocity applied to the sectional area of the stream at the point where the observations are taken enables the observer to calculate with sufficient accuracy the volume of water discharged by the river in a given time.

The second method, namely, gauging by means of a weir erected on the river, is usually applied to smaller streams, and it is to the improvement of this method my invention is intended to be applied. In this case a weir is erected across the river, and a lath set up marked off in inches and decimal parts, and readings of the height of the water above the sill of the weir are taken from time to time, and from these, by the aid of the usual hydraulic formulæ applicable to the stream, the quantity of water passing over the weir at any particular time may be calculated. The great drawbacks of this system are its inefficiency and costliness.

Digitized by Google

The instrument I have designed consists of a copper float which rises or falls with the water in the stream in which it floats freely; attached to this float is a rod carrying a pencil which is pressed by a spring against a cylinder on which is fixed a sheet of graduated recording paper. Inside the cylinder is placed clockwork to turn it on its vertical axis, and constructed to go fourteen days. As the cylinder is turned by the clockwork the pencil attached to the float marks the height of the water on the paper graduated to inches and decimal parts. The whole of the apparatus is intended to be enclosed in a wooden case and attached to a post driven into the bed of the river and fenced round for its protection. The instrument is designed on a principle similar to that of instruments for recording automatically other kinds of observations, but, so far as I know, no previous instrument has been designed for river gauging.

The following are the advantages of the instrument:—

1. *Efficiency.*—The record of the instrument will be continuous day and night. The present system of taking such observations say, only twice a day, is very imperfect, as in the intervals floods may come down the river and pass the gauge unrecorded, and, in this way, all present river gaugings are more or less inaccurate.

2. *Economy.*—As pointed out, this gauge can be fixed on a stream and left in operation, and only requires to be visited once in fourteen days; for this reason the expenses of an official in constant attendance can be dispensed with. As to the cost of the instrument, a leading instrument maker of Adelaide has estimated the cost at about twenty pounds.

3. *Saving of Time.*—This instrument, if adopted, would facilitate the important work of gauging the flow of water in our rivers, as, by fixing an instrument on each stream, a large number can be gauged simultaneously; in fact, the work could be carried on with accuracy and inexpensiveness, and the records collected and sent in as regularly as our rainfall observations are now taken throughout the colony.

I will only add that I have handed over my invention to the Government of this colony, with the hope that it may be utilized by them in the important work which has now been undertaken of taking gaugings of the flow of our streams in South Australia.

Digitized by Google

Preliminary Notes on a New Australian Mammal.

By E. C. Stirling, M.A., M.D., Lecturer on Physiology in the Adelaide University.

[Read September 4, 1888.]

A few days ago, through the kindness of Mr. A. Molineux, of Adelaide, a small mole-like animal, which appears to be new to science, was forwarded to the South Australian Museum. It was found on the Idracowie Cattle Station at a distance, I understand, of about 100 miles from the Charlotte Waters Telegraph Station, on the overland line from Adelaide to Port Darwin, but the exact circumstances of its capture are not yet to hand. The collector, however, reports that it must be of rare occurrence, as on questioning the aboriginals of the locality, there was only one old woman who said she had seen it before, and that upon a single occasion. It is evidently an underground burrowing animal, resembling somewhat the Cape Mole (Chrysochloris) in its general external appearance, but differing in many respects. The total length is 13 cm., inclusive of the tail, which is two cm. long. The head, relatively shorter than Chrysochloris, has a rounded muzzle, the dorsal surface of which is covered by a horny shield. Nostrils transversely slit-like. No eyes visible, the skin passing uninterruptedly over the ocular region, but on reflecting the skin in one side of the face a small circular pigment spot is visible on the position of the eye. No apparent bony orbit. Tongue fleshy, broad at the base and tapering to a blunt point. No external ears, but the ear-openings distinct, one mm. wide, and covered over with fur. The fore limbs are short, resembling somewhat those of a mole, but the manus is folded, so that the large nails of the fourth and fifth digits only are visible in the natural position of the limbs. Of these nails, the fourth is 15 mm. long, and of a uniform width of four mm., ending very bluntly; the fifth is very slightly shorter than the fourth, broad at the base (eight mm.), tapering rapidly to a blunt point, the two together forming an outline rather like that of a goose-mussel (Lepas). The nails of the third, second and first digits, very much smaller, form a series gradually diminishing in size in the order named, and constitute a second row on the inside of the fourth and fifth, by which, as stated, they are completely concealed from view. What

Digitized by Google

corresponds to the palm is the cleft between the two rows of digits. The hind limbs are also short, with the soles turned outwards. What appears to be the fifth (anterior) digit is very short, with a short, broad, and strong nail; the fourth is armed with a long (seven mm.), narrow, curved, and sharp claw; while the claws of the third, second, and first are broad, flat, rounded at their points, and joined together by a membrane which extends nearly to their points. On the sole there is a hard, elongated, horny tubercle crossing it transversely. The tail, two cm. long and five mm. wide at the insertion, tapers to three mm., and terminates in a knob-like tip.

About 15 mm. in front of the vent (? cloaca) there is a pouch in the integument about 4 mm. wide with the opening directed backwards and having a depth in a forward direction of from 4 to 5 mm. The surface of this pouch is devoid of hair, but the bare area is surrounded by thick fawn coloured fur with a slightly reddish tint. It is, however, possible that this reddish tint is due wholly or in part to some ferruginous looking sand which is much mixed up with the fur. The body generally, with the exception of the lower two-thirds of the tail, which is bare, is covered with fur of a rather lighter tint.

With regard to the internal parts, it is unfortunate that the specimen came to us completely eviscerated and in a bad state of preservation generally, but in a small part of the lower bowel which was left remains of ants were found. The bowel terminates at a wide vent (? cloaca) and I can find no trace of a separate genital aperture, nor of such openings into the supposed cloaca.

I have not yet had time to examine with minuteness the skeleton, which unfortunately is also considerably damaged, especially about the occipital region, but from a cursory examination of the recently skinned body I can note the following points, with, I believe, accuracy:—Cranium relatively large; no bony orbits; zygomatic arches present. Well developed shoulder girdles with slender clavicles. Pectoral muscles large. Pelvis large and strong, with a rather wide pubic symphysis, but no epipubic bones either actual or rudimentary. Ribs, 14. Angle of lower jaw markedly inflected. The teeth are peculiar, and require a more extended description than I can give at present, but the formula appears to be i. $\frac{3}{3}$, c. $\frac{1}{1}$, m. $\frac{6}{6}$ ($?\frac{p.\,2,\,m.\,4}{p.\,1,\,m.\,4}$); this however may require some modification, as just posterior and external to the præmolar (or first molar) of the right ramus of the mandible there is a small rudimentary conical tooth which is not to be found on the opposite side or at corresponding positions in the maxilla.

Until a more extended examination has been made of the skeleton and teeth of this animal, I purposely abstain from ex-

Digitized by Google

pressing a definite opinion as to its nature and affinities, and the following remarks must be taken as provisional only.

Though the integumentary pouch and marked inflection of the angle of the mandible point to its marsupial nature, there is no trace, even in a rudimentary form, of epipubic or marsupial bones, which are nearly always present in the marsupialia. On the other hand, the absence of a separate urgo-genital orifice (if this should be confirmed) suggests that it is a new member of the order Monotremata, of which the Platypus and Echidnas are the only known representatives. The characters of the manus and pes, the well-developed shoulder girdle and relatively large pectoral muscles, together with the absence or extremely rudimentary condition of the eyes, are plainly suggestive of the subterranean, burrowing, and probably nocturnal habits; while the character of the teeth and the actual contents of what little there was left of the lower bowel prove it to be insectivorous in its feeding.

The dentition is certainly remarkable, and both in the shape of the mandible and in the general characters of the teeth there appears both to Mr. Zietz and myself a strong resemblance to the pictures of the fossil jaws of the extinct Amphitherium figured in the works of Owen and others. If this resemblance should be confirmed by closer examination, the discovery of this animal, apart from its mole-like characters, will be of high zoological interest, inasmuch as these jaws of Amphitherium found in the lower Oolite at Stonesfield, in Oxfordshire, associated with the remains of Plesiosaurs and Pterodactyls, are among the earliest remains of the class Mammalia known to the geologist.

On the interesting points which are raised by this supposed resemblance it is, however, unsafe to speculate at present, nor, as will have been seen, are we yet in a position to define with certainty its relation to existing types. I merely submit to the Society these preliminary and necessarily incomplete notes in deference to the interest which has been excited by the announcement of the discovery of this very interesting animal, singular even in this land of curious and antique types.

To Mr. Zietz, assistant Museum Director, I am much indebted for valuable assistance in the preparation and examination of the specimen.

Since the above notes were in type, Mr. A. Molineux has been good enough to forward me an extract from a letter recently received by him from his nephew, Mr. Charles Benham, who originally found the animal. Mr. Benham writes as follows:—"I found it during daylight about 4 p.m., on a big sand hill. I tracked it for about fifteen yards, but saw no burrow. It would crawl or walk a few feet, and then scratch a very small hole, then go on again and scratch another hole. There was no known

Digitized by Google

water within ten miles of the place where it was found, but there is a prickly bush with water in its roots growing on the sand hills. The animal seems to be very scarce, as this is the first that has been seen by white men about here, and there was only one old black woman who said she had seen it before. She called it by a name which sounded like "Aurachamater." I did not notice any pouch.

Digitized by Google

Notes on the Surface Features and Rocks of Nuriootpa and its Neighbourhood.

By J. G. O. Tepper.

[Read April 3rd, 1888.]

Nuriootpa, a small township on the eastern boundary of the Hundred of Nuriootpa, is on the banks of the North Para River. Almost level flats surround it, extending eastward to the foot of the Angaston Hills, which are an extension of the Barossa Ranges, culminating in Mount Kaiserstuhl, 1,980 feet. In this direction the width of the flat plain is about three miles. Westward the Greenock and Mappa hills bound it at a distance of one to two miles. Northward it extends to within a mile or so of Stockwell, and north-westwards still further for some six or seven miles, being finally blocked by the junction of the Kapunda and Truro hills. Southward it gently rises to a low ridge, at the western end of which Tanunda is situated, and descends rapidly to a lower flat, in which Betany is situated, and through which, in a transverse direction, *i.e.*, east to west, Tanunda Creek flows. From here the same formation of the ground is repeated—that is, the flat between the river, which here, as far the greater part of the way from Nuriootpa to Tanunda, skirts the hills on the western side—and the ranges to the east gradually rise, crossed by a number of deeply-excavated creeks, until gradually terminated by spurs from the eastern hills. Beyond these spurs the same feature is again repeated where intersected by the Pewsey Vale road; but the flat is now divided into two by a narrow range of hills stretching in a curve from north to south chiefly. The eastern flat is at first narrow, containing at the foot of the steep first hills a small permanent lagoon of oval form, and about ten acres in extent. Beyond a narrow low ridge formed by a spur from the last-mentioned hill, the flat widens, and contains the shallow Hoffnungs lagoon of irregular form and an area of about 120 acres. The southern end of this flat is traversed by a creek some seven or eight feet above the level of the lagoon, and finally narrowing to about one-sixth of a mile, joins the Lyndoch Valley flat.

To the west of the range of hills just mentioned, and at the northern end, the flat is interrupted by a somewhat rapid descent of about 200 feet to the Lyndoch Valley, which is a nearly level

Digitized by Google

flat some four or five miles long by about a mile to two miles wide, through which a rather large creek flows, and which in former times was famous for its great fertility of soil.

The hills, dividing the two flats or wide valleys as well as those on east and south, consist of micaceous and hornblendic schists, and show here and there remarkably steep inclines. Those on the west are much younger, and exhibit ferruginous shales and conglomerates. Spurs extend far into the flat here and there. The soil of the latter is on the surface, near the centre a black tenacious clayey mould, but much more sandy nearer the margin. Below this i s a dense extremely sticky grey or white clay, with numerous fantastically-formed calcareous concretions. This changes into sandy ferruginous loam, with lime nodules, which has not been pierced by wells at a depth of 70 to 80 feet; but near the southern extremity, at 40 feet and less, pure sand and coarse gravel was reached, bearing fresh water. These various flats present semblances of the bottoms of a chain of lakes drained by the bursting or wearing away of comparatively narrow barriers of hard rocks, and the flat at Lyndoch shows these features of such lacustrine origin much more conclusively than the larger and less hill-bound ones.

The surface soil in the flat at Nuriootpa township along the course of the river is a rich black mould many feet in thickness; farther to the north a more or less adhesive clay prevails, as likewise towards the east from Nuriootpa. The township itself stands upon a fertile sand, gradually merging into the sandhills west and north-westward. South and south-east more or less loose, either fertile or almost barren sand prevails to within a mile of Tanunda. Below the sand and mould, which are of slight thickness at places or missing altogether, follows first a yellowish, sandy, and gravelly clay, in many places sufficiently pure and plastic for bricks, and from 20 to 40 feet or more thick. Underlying this and occasionally rising to the surface is a white and blue very adhesive clay, here and there stained deep rusty, and which is remarkable on account of including layers of impure salt, which were first observed in a bank of the river towards Tanunda associated with thin hard layers of a ferruginous cement, subsequently traced at various other places. No doubt this is the cause why so many saline springs exist along the river. Even the wells become brackish and finally undrinkable in those areas which have this formation. As no fossils have been found the age is doubtful, but I think may be assumed to be either the latest Tertiary or early Pleistocene. The thickness seen varied from about two feet to over five, but as this was near the edge of the basin it must be much thicker in the middle.

Under the blue clay follows a white, yellow, or red sandstone,

Digitized by Google

porous and water bearing, but of unknown thickness, nor is it known what is below it, as at a depth of, I believe, about 200 feet reached by boring near the hotel in search for kerosine or coal, the base rock was not reached. The river crosses the flat obliquely east of the township, no where showing rocks in the bed, but instead has mostly boggy banks on account of the many springs, usually weak and some saline in summer. An old bed, now broad and shallow, winds through and west of the township, joining the river where it approaches the western hills. Its watershed on this side is very close, only from half a mile to two miles distant, and skirting it, an interrupted band of the well-known "IRONSTONE" occurs, probably marking the edge of the former lake, but is wholly absent on the eastern side. In structure it varies from that of a real sandstone finely and evenly grained to a coarse conglomerate of pebbles three to six inches in diameter. Sometimes cavities, as if shells had been removed, are found in it, but no fossils were ever seen here, except a fragment of wood converted into brown hæmatite, found S.W. of Tanunda.

Where undisturbed and developed to a considerable extent the uneven surface is homogeneous, but with occasional round holes penetrating deeply and allowing the water to flow off. Its thickness is nowhere exceeding two feet.

A very interesting rock is a very hard grey sandstone grit, which here and there is found fringing low ridges. It consists of pure grains of semitransparent quartz cemented by silica of the same character and inclosing a few larger pebbles but rarely. Sparingly dispersed occur tortuous holes, as if formed by worms. This rock is from 18 inches to three feet thick, rests on red clay, and is sometimes overlain by the ironstone. A similar but more jaspery rock occurs on the hillsides near Sheaoak Log, showing numerous root-like enclosures.

The older rocks in the eastern as well as the western hill ranges consist of micaceous and hornblendic schists, gneiss, quartzites, and near Greenock granite. The last is intrusive at and near the anticline, which is at a high angle. It outcrops only near the base of depressions, but never on the heights. The principal place observed is in the north-east corner of section 1817, near Greenock, and indications in section 208.

The strike of the old pre-silurian rocks varies a few degrees beyond the magnetic and true north and south, while the dip is usually at very high angles. At Angaston, in a small quarry near Mr. Salter's residence, the hornblendic strata are undulating, and the dip varying between 48° and 65° *westerly* (strike N., 7° W.). Similar strata near Greenock, in the cutting of the road, gave a similar strike, but a dip of 62° to 68° easterly, while

Digitized by Google

that of the west side of the anticline was 77° westerly. The protrusion of the granite is in the line of strike of this anticline and northward. Near this place cyanite, a rather rare mineral, is found in quartz veins. A fine grained, very hard white sandstone occurs in sections 554 and 683, forming a bank-trending nearly east and west, cleaving into almost right-angled blocks, and quite local. Magnesian limestone and a seam of very hard kaolin were noticed near Moppa, and a vein of baryta on the road near Greenock.

At Tanunda, between sections 43 and 38, the river has broken through quartzites, sandstones, and micaceous slate, which probably was the original barrier above which the waters of the upper lake were confined. By the strike of intervening masses of similar rocks they appear as a continuation of those forming the highest ridge between Greenock and Nuriootpa. Another barrier, very thick, occurs north of Jacob's Creek, and beyond Rowlands Flat the banks of the river become high and precipitous, attaining from its sharp south-easterly bend for several miles an elevation of about 200 feet. The base is formed of the old rocks dipping at steep angles, mostly easterly, The greater part above is formed of conglomerates, gravels, clay, and sand. At the ford at Both's Mill, sections 560 and 1806, and farther past the village at Rosenthal, clay slates, frequently very fine grained and fissile, come in and reach to the summits of the hills, rising 200 to 300 feet above the river bed, and narrowing it extremely. The gradual wearing through these hills obviously opened a way for the escape of the waters accumulated over the Lyndoch Valley.

Above the clay slates, and intercalated with them, occur thinner or thicker seams of crystalline limestone, mostly of a bluish or grey tint, and also iron spar, with perfect cleavage, is met with. In the bed of the creek, about section 1700, a perfectly black coarse slate is found locally, and in section 1692 a dyke occurs of volcanic or pseudo-volcanic rock, being formed of large and smaller angular fragments united by a homogeneous cement. It is traceable in the direction of its strike, south-west and north-east, for several hundred yards, and has a width of 20 or 30 yards. In the neighbourhood also occur jasper and chalcedony in large blocks, now no longer to be seen *in situ*, but removed for road metal or lying along the fences. About section 806 the highest point is reached for this part, called Schoof's Hill. It is composed of a highly indurated silicious slate rock, with very imperfect cleavage, flanked eastward by a ridge of soft micaceous slates.

North of this, in sections 101 and 102, this limestone assumes large proportions, forming a hill, on which the Wheal Nitschke Copper Mine was worked.

Digitized by Google

The surface soil of all these hills is a deep brown or red clay, very fertile; in fact, a great part is the famous Bay of Biscay soil. Here and there, where thin, it is mixed with stones, the fragments of the base rocks. The higher ridges are usually crowned by soft travertine in patches, gradually broken up, removed, and the ground turned into wheatfields.

Of the above rocky and hilly character is all that eastern part of the district of Nuriootpa between the river in the east and Rosenthal in the south, and the Nuriootpa Flat and Daveyston in the north, developing further on into the Mappa Hills north-eastward of Greenock and the Belvidere Ranges west, the whole of this part of the district—besides the very narrow strip along the river—being drained by the Salt Creek and the smaller New Mecklenburg Creek. The former having received its name from the saline character of its numerous small but permanent springs in the lower two-thirds of its course.

At the foot of this hilly region in the west extends a wide flat, the surface formed of red or yellow clay, and below of the same kind of sandy calcareous loam or marl, forming the precipitous banks of the Torrens at the Botanic Bridge. It dries loose in ummer, deep cracks forming in many parts, and when heavy showers give rise to sudden floods deep crevices are formed in a short time.

West of this flat, which formerly was almost wholly covered by dense mallee growth of which but small remnants are left, the land rises into gentle undulations, the surface covered by red clay and Bay of Biscay ground. The neighbourhood of the river, is flanked by hills of the old rocks on both sides, while the summits and sides bear mostly the same covering of red clay.

Digitized by Google

Notes on the Muddy Creek Beds, with brief Remarks on other Tertiary Strata of South Western Victoria.

By John Dennant, F.G.S., Corr. Memb.

[Read October 2nd, 1888.]

PLATE I.

I. Introduction.

Perhaps there are no fossiliferous deposits in Australia which have been more frequently visited than the Muddy Creek beds, not only by geologists, but also by those led thither by curiosity merely. Their short distance from Hamilton, the beauty of the scenery, the ease with which the fossils can be obtained, and last, but not least, the warm welcome accorded to visitors by the proprietors of the land where the beds are situated, combine to make Muddy Creek an especially pleasant place for a day's outing.

Up to the present time, however, no attempt has, I believe, been made to describe the strata, though the fossils themselves have engaged the attention of our ablest palæontologists. Many years ago, the Rev. J. T. Woods worked industriously at the beds, and to him we are indebted for a knowledge of a large number of the most characteristic forms found in them. Subsequently, Professor Tate spent some time at Muddy Creek, and made an extensive collection of fossils, including many new species. Since then, owing to the labours of various collectors, the material awaiting description has been gradually accumulating. A perusal of the Transactions of this Society for the last few years will show that Professor Tate has made great progress in dealing with it, especially of late, in his systematic revision of the Australian Tertiary Mollusca, three instalments of which have already appeared. In the Prodromus of the Palæontology of Victoria, Professor McCoy has published excellent drawings and descriptions of about 35 species found in the Muddy Creek beds. Descriptions of many species have also been given by the Rev. J. T. Woods, F.G.S., in the Transactions of the principal Scientific Societies of the colonies.

Nor have the English geologists been behindhand in the interest taken in these and other Australian Tertiary deposits, the Quarterly Journal of the Geological Society containing valuable memoirs upon the Corals and the Echinodermata by Professor M. Duncan, and upon the Bryozoa by Mr. A. W. Waters, F.G.S.

Digitized by Google

My remarks in this article will refer principally to the position of the beds, to their relation to adjoining strata, and to the difference in geological age, which I conceive to exist between certain portions of the shell deposits. As full a list of the Mollusca as can be made out at present will be added, as necessary for the illustration of the point last named.

In its course towards the Wannon, the Grange Burn is joined by two tributaries, viz., Muddy Creek and Violet Creek. Although all three are insignificant streams, and confined now in narrow channels, yet the valleys through which they flow are not only wide, but depressed considerably below the level of the surrounding country. I have not observed any fossil outcrops in the Violet Creek, which is the more remarkable, as they occur in so many places in both the Grange Burn and Muddy Creek.

It may be mentioned here that the term "Muddy Creek" beds is used by common consent, as a convenient name for the whole series of fossiliferous strata in this locality, and must be understood, therefore, to include not only the deposits of Muddy Creek itself, but also those of the Grange Burn, close at hand.

The distance of Muddy Creek from the sea is about 40 miles, while the fossil-bearing strata (in the place marked "*a*" in the map) are 385 feet above sea level. Mr. S. Mason's house on the table-land overlooking the creek is 130 feet higher, or 515 feet above sea level. This may be regarded as the general elevation of the country in the neighbourhood, the slope to the sea-coast being very gradual. These and the other levels given later on are aneroid measurements of my own. The meteorological station at Hamilton, about five miles distant, which is exactly 640 feet above sea level, has been adopted as the starting point for the observations made in the neighbourhood of Muddy Creek. In other localities, either the sea itself, or some known elevation, has formed a basis to work from.

Going northwards from the Grange Burn, no outcrops of the marine tertiaries occur in the whole of the county of Dundas, except a small outlier towards its extreme western boundary, on the margin of the River Glenelg. This region, lying between the Grange Burn and the Wannon on the south, and the Glenelg on the north, forms a plateau, occupied by palæozoic, granitic, trappean, and metamorphic rocks, and probably stood at too great an elevation during tertiary times to be submerged.

To the north and north-west of the Glenelg, however, the marine beds again appear, and continue almost without interruption over a vast extent of country, the river in this part of its course marking a well-defined geological boundary.

By going along the Grange Burn to the westward, we soon lose sight of the tertiaries, the mesozoic strata—which they, no-

Digitized by Google

doubt, immediately overlie in that direction—appearing as the surface rocks. The intervening country between the tertiary and the mesozoic outcrops is occupied by basalt and drift accumulations, so that no actual junction of the two formations can be found. A little to the west of Merino, however, I have gathered casts in ironstone of characteristic Muddy Creek shells in the immediate vicinity of the underlying secondary rocks. Further west still, on the Glenelg River, the mesozoic strata entirely disappear, the marine tertiaries alone being visible, not only to the border of the colony, but far beyond it. These deposits are, in fact, found only as a fringe on the eastern, southern, and western margins of the mesozoic area, its central and northern portions showing no signs of them, and it is doubtful, therefore, whether the formation, as a whole, was ever covered by the tertiary sea.

It has been thought by some geologists, whose opinions are entitled to great respect, that the mesozoic beds pass under the tertiaries right down to the coast, and also for long distances both to the east and west. There appear to me to be some objections to this theory, which I will now state.

1. There is no outcrop whatever of mesozoic strata in the whole of south-western Victoria, except in the limited area of the Wannon Valley.

2. The shales, sandstones, and silicious limestones, of which the secondary beds consist, are either horizontal or nearly so, wherever I have examined them, while in order to pass, as supposed, completely out of sight under the tertiary beds, they would require to assume all at once a high inclination. Thus, near Merino, the mesozoic strata are found at an elevation of 396 feet above sea level, while on the cliffs of the Glenelg, only a few miles to the west, a thickness of more than 100 feet of the tertiary strata is exposed, the river having hollowed out its channel to a great depth below the general level of the country. Here there is no sign of the mesozoic strata, which we should certainly expect to find if such horizontally disposed beds extended far in a westerly direction. Again, at Heywood (see section, fig. 2), the tertiary strata have been bored into, to a depth of 190 feet below sea level, in searching for water, without discovering any change in the formation.

3. The mesozoic strata are, I believe, of no great thickness in this part of Victoria, and, therefore, not likely to prevail over a wide area. The rocks underlying them, viz., micaceous, quartzose, and felspathic schists (the so-called metamorphic rocks of the district), crop up at no great depth in two localities known to me, one of which is about eight miles north of Coleraine, in the bed of the Koroite Creek, towards the northern margin of the formation, and the other, at about its centre, on the banks of the Wannon, near the Winninburn homestead.

Digitized by Google

To the south, south-west, and south-east of Muddy Creek, the tertiary beds crop out in various places, as at Branxholme, Arrandoovong Creek, Byaduk, Lake Condah, Mount Eccles, Heywood, Bessiebelle, Portland, &c., and it may therefore be affirmed with tolerable certainty that the formation is continuous at no great depth below the surface right down to the coast. From the various localities mentioned, fossils have been obtained, many of which I have examined. Between the Grange Burn and the sea, several lava flows, more recent than any of the tertiary deposits, conceal the sedimentary strata, but when wells have been sunk, a layer of shells has usually been met with at a moderate depth.

On the east of the Muddy Creek beds, the country is so completely covered by lava, that the underlying strata are invisible, and I can offer no opinion as to the extension of the tertiaries in that direction.

The shell deposits of Muddy Creek are seen in some places at a considerable height above the surface of the water, but in others, they appear to sink quite below the bed of the stream, and thus become invisible, reappearing perhaps at the next bend, high up on the bank. The difference in the level of the fossil sections is no doubt due, in a great measure, to the action of the creek itself, which, after working its way through the superincumbent basalt, and thus reaching the tertiary strata, has eroded them also, carrying away the more friable portions, and leaving minor depressions in their surface, which, in the course of time, have been filled up by the loose soil and boulders washed down from above. The gently sloping banks on the shores of Muddy Creek, where no fossil beds are in sight, have probably been formed in this way.

In one place, however, this stream flows over a mass of basalt in its bed, forming a miniature waterfall, and here the igneous rocks must be in their original position, which is a good deal below the level at which they are found, when seen in contact with the fossil outcrops close at hand, and their presence at such a depth can only be accounted for by supposing that the sedimentary deposits had been hollowed out prior to the igneous outflow. It should be noted that the tertiary strata are horizontal, not only at Muddy Creek, but throughout the whole of the district, so that any irregularity of their surface can only arise from denudation.

II. The Fossiliferous Beds.

In both the Muddy Creek and Grange Burn sections, the shells are usually embedded in argillaceous and calcareous bands, the colour of which varies a good deal, the former having often a

Digitized by Google

bluish tinge, while the latter are reddish, the depth of the tint depending upon the degree of oxidation of the iron they contain. Very fine and perfect shells are often found amongst the bluish-coloured clays, especially large volutes and cowries. The bands are horizontal, and though they no doubt indicate some slight difference in the deposition of the sediments, similar shells occur both in the blue clays and the red calcareous layers. It is true that some of the bands contain more fossils than others, but still shells can be obtained in a greater or less quantity in any part of the strata.

I have hitherto spoken of the fossiliferous strata of the Muddy and Grange Creeks as a whole, without indicating definitely the distinction as to age which undoubtedly exists among them. So far as the Muddy Creek itself is concerned, all the beds known consist of the clayey and calcareous layers already noticed, but in the Grange Burn, fossiliferous strata of a different character appear, which have not, I think, been referred to by any previous geological writer. They form a rather friable rock, composed mainly of bryozoan remains, with spines of echini, and occasional shells, chiefly pectens, scattered through it. In outward appearance, it resembles almost exactly the strata on the Crawford River, about half way between Muddy Creek and the south coast of Victoria. Somewhat similar strata are also found at Apsley, on the western boundary of Victoria, and also at Narracoorte in South Australia. Those at the last-named place are described by Professor Tate under the name of "polyzoal rock," which in his classification of the Australian Tertiaries he has placed as antecedent in age to the Muddy Creek shell beds. In one place only have I seen the strata in close proximity, and there the polyzoal rock appeared to underlie the shell beds. As, however, I was unable to trace their actual contact, I am not prepared to speak definitely on the point. As said before, this rock is nowhere visible in the Muddy Creek, but it abounds in the Grange Burn, not only above, but also for a long way below its junction with Muddy Creek. The identifiable shells in it are few, and these even are with difficulty extracted whole, so that its thorough examination will be a work of time. As my own labours, so far, have been almost entirely restricted to the shell-beds, I can do little more at present than direct attention to this interesting formation.

As is well known, geologists are not entirely in accord concerning the relative ages of the various tertiary strata of Victoria, South Australia, and Tasmania. Professor Duncan, judging from the evidence of the corals and echinodermata, advises that they should all be called cainozoic simply, without attempting further subdivision. The mollusca, however, tell a much more certain

Digitized by Google

tale, and prove clearly enough that several well-defined zones exist among the Australian tertiaries. The diversity of opinion as to the precise position of certain beds in the series is due, no doubt, in a great measure, to the partial manner in which they have been as yet explored. In the case of the Muddy Creek beds—the most important, perhaps, of the whole series—much confusion has arisen in the past from the mixing together of fossils obtained from two different members of the group.

It has long been known to collectors of Muddy Creek fossils, that certain species of shells occur only in special portions of the beds; but as some forms are common to all localities, the variation was thought to be less than it really is. Some observations lately made show, however, not only that the difference is a marked and constant one, but disclose also the important fact that the shells are different according as they are gathered above or below a particular elevation, sections of equivalent height yielding always the same species. When the fossils from the Grange Burn, at Forsyth's (see map), were placed side by side with those from Muddy Creek, at Clifton Bank, and the few species common to both outcrops removed, it became evident that two distinct deposits were represented.

Examples of the following species are numerous in the first-named place:—

Triton Quoyi
Nassa crassigranosa
sublirella
Marginella muscaroides
(aff.) ovulum
Ancillaria papillata
Cancellaria Wannonensis
Terebra catenifera
Natica gibbosa
Pelicaria coronata
Lampania rubricata
Nerita melanotragus
Leiopyrga cingulata
Ostrea manubriata
Mytilus Hamiltonensis
Nucula tumida
Leda acinaciformis
Limopsis Belcheri
Pectunculus cainozoicus
McCoyii
convexus
Trigonia Howitti
Crassatella oblonga
Chione subroborata
propinqua
Cytherea paucirugata
Dosinia Johnstoni
Meroe gibberula
Psammobia Hamiltonensis
Mactra axiniformis
Hamiltonensis
Corbula ephamilla *(var.)*

At Clifton bank there is a much greater variety of species, but, on the whole, fewer individual specimens. The more commonly occurring forms are:—

Murex lophœssus
Ranella Pratti
Triton Woodsii
Pusionella hemiothone
Pleurotoma perarata
Haastii

Digitized by Google

Triton textilis
tortirostris
Fusus craspedotus
Dennantia Ino
Nassa Tatei
Voluta antiscalaris
McCoyii
strophodon
Weldii
polita
sarissa
Lyria harpularia
Marginella Woodsii
propinqua
inermis
Winteri
Wentworthi
Ancillaria pseudaustralis
Entalis Mantelli
Cylichna exigua
Terebratula vitreoides
Waldheimia Garibaldiana
Dimya dissimilis
Pecten Murrayanus
Yahlensis
Lima Jeffreysiana
Spondylus pseudoradula
Leda vagans
Pleurotoma Claræ
Mangelia bidens
Clavatula fusilla
Daphnella gracillima
Conus Ralphii
pullulescens
Cypræa contusa
Murraviana
Trivia avellanoides
Cassis exigua
Semicassis transenna
Natica gibbosa
polita
Solarium acutum
Cerithium apheles
Liotia Roblini
Minolia strigata
Entalis annulatum
Limopsis Belcheri
Pectunculus cainozoicus
McCoyii
Cucullaea Corioensis
Trigonia semiundulata
Crassatella Dennanti
Cardita gracilicostata
Corbula ephamilla
Placotrochus deltoideus
elongatus

It is important to note the relative elevation of these outcrops. By aneroid observations, I make Clifton bank 385 feet, and Forsyth's bank 420 feet, above sea level, giving a difference of 35 feet in the heights of the two places.

From a comparison of the fauna in the two beds, and from other evidence to be adduced directly, I conclude that the deposit at Forsyth's belongs to a later epoch than that at Clifton. The two zones, which are now generally recognised, in the Muddy Creek shell beds are, in fact, well typified in these localities, viz., the upper or younger at the first, and the lower or older at the second.

It was on the Grange Burn that I first became convinced of the distinction between the two sets of shell beds, but the evidence at Muddy Creek is, in reality, far more conclusive, for there we are enabled to see their actual junction. At the Clifton section, only the lower beds are visible, but a few chains higher up the stream, the upper beds crop out just under the basalt, on the face of a steep bank. The upper half of this bank,

Digitized by Google

the total height of which is about ten feet, was cut down some years ago in searching for cetotolites and other cetacean remains, when a band of nodules and fragments of whales' bones, mixed with upper bed shells, was reached, but the strata then becoming hard, and apparently unproductive of fossils, the remaining portion was not uncovered. As I had seen lower bed shells in close proximity to this place, I employed a man to cut down the whole of the bank, and thus give a perpendicular section. The result was gratifying. The nodule band, which is only a few inches in width, proved to be the actual division between the upper and lower deposits. Above it, the most characteristic shells of the upper zone were found in profusion, beneath it, the species obtained were, almost without exception, those peculiar to the lower zone.

In the topmost strata, in addition to many other characteristic species, numerous and very fine examples of the following occur:—

Solen sordidus	Zenatiopsis angustata
Dosinia Johnstoni	Nucula tumida
Barnea tiara	Leda acinaciformis
Mactra axiniformis	Crassatella oblonga
Hamiltonensis	Cytherea paucirugata

The inferior beds are not nearly so well represented here as at Clifton Bank, and other places lower down the creek, the shells being fragile, and not very abundant. The following, amongst other typical forms, were collected immediately beneath the nodules :—

Voluta strophodon	Dimya dissimilis
antiscalaris	Leda vagans
Conus Ralphii	Trigonia semiundulata
Terebratula vitreoides	Lucina araneosa

The elevation of the nodule band is 410 feet above sea level. Farther up the stream, and therefore at a higher level, only the superior beds are in sight. From a fine outcrop of these (marked "*c*" on map), a large collection of fossils has been made, chiefly by Mr. McDonald, the result being the discovery of several new species peculiar to the upper zone, as—

Voluta Masoni	Eligmope Dennanti
Siphonalia spatiosa	Pecten subconvexus
Nassa sublirella	Triton ovoideus
Pelicaria coronata	Pectunculus convexus, &c.

The fossiliferous strata crop out almost continuously on the banks of Muddy Creek between this spot and the falls, but wherever examined, they are found to consist of either the upper or lower beds, according as they lie above or below the level of the nodule band.

Digitized by Google

The same can, I think, be said for the Grange Burn, but as, with the exception of the one quoted, the sections are not good, they have not offered the same attractions to the collector as the more productive ones of Muddy Creek, and are therefore not so well explored. I have on several occasions searched the banks of this stream from Forsyth's down to the junction, gathering shells wherever they could be found. At one place, the height of which is 390 feet above sea level, and thus 20 feet lower than the nodule band, I dug out a tolerable number of shells, but they were in so fragile a condition, that only a small proportion remained whole when touched. As the elevation led me to expect, the deposit proved to belong to the earlier formation, none but lower bed fossils being found. Amongst other characteristic forms collected may be mentioned—

Voluta antiscalaris	Leda vagans
strophodon	Lucina araneosa
Trigonia semiundulata	Cucullæa Corioensis
Lima Jeffreysiana	Placotrochus deltoideus

The section bears a very close resemblance to that immediately beneath the nodule band at Muddy Creek. Identical fossils occur, and in both the shells are comparatively scarce, as well as fragile.

The only place in which the nodule band is well seen is at the spot mentioned on the Muddy Creek, where it has been laid bare for a distance of about 30 feet along the face of the bank. Like the beds which it divides so sharply, it is horizontal, while its width varies little, if any, right across the section. As it is only about six feet above the water's edge, it cannot be traced much farther either *up* or *down* the stream, since in the first case, it soon passes under the bed of the creek, as this rises with the slope of the ground, while in the latter, both it and the beds overlying it have been removed by denuding agencies, the lower beds alone cropping out as the altitude decreases.

On the Grange Burn, at about an equal elevation, similar nodules, whales' bones, &c., are found in the actual bed of the stream, and though the layer is much thicker than at Muddy Creek, it probably belongs to the same deposit. The Grange Burn layer is the favourite hunting place for sharks' teeth, which are so numerous in it that one man lately obtained as many as 30 by a few hours' work. Other curious remains are fairly abundant at the same place, as ear bones, vertebræ, and snout bones of whales, fish palates, &c. These are sometimes mineralised, but not unfrequently the bony structure is well preserved.

The nodules themselves are rolled fragments of many sizes and shapes, but all more or less rounded. Their colour, which is dark-

Digitized by Google

brown, is due to the iron they contain. Enclosed in them, as an essential part of their mass, there are minute pieces of shells, and an abundance of foraminifera, the presence of the last pointing to their derivation from the lower beds. Dr. J. E. Taylor, F.G.S., who visited Muddy Creek with me, was much interested in these nodules, saying they reminded him of the so-called coprolite beds at the base of the Red Crag in Suffolk, and advised me to test them for phosphates. A specimen was accordingly analysed, but the phosphoric acid amounted only to 11·9 per cent., the main ingredients being carbonate of lime, ferric-oxide, and alumina.

In the following summary and table of species belonging to the respective beds, I have taken account only of the Mollusca proper. The brachiopods, pteropods, and, with one or two exceptions, the bivalves mentioned have been described by Professor Tate, the Rev. J. T. Woods, and others. The gasteropods are, as yet, only partially described, and I have to thank Professor Tate for permission to quote his manuscript names for a large number of them. The list is not exhaustive, as there are many species yet to be examined. As some species are only known from examples obtained before the distinction between the two deposits was recognised, and the fossils from each kept separate, it is not possible to refer them to the particular bed in which they occur, until fresh specimens are found, and they are, therefore, for the present, merely recorded as Muddy Creek shells.

I. Summary of Species.

Classes.	1. No. of Species peculiar to lower beds.	2. No. of Species peculiar to upper beds.	3. No. of Species common to both beds.	4. No. of Species not referred to a particular bed.	Total.
Cephalopoda	3	0	0	0	3
Gasteropoda { Siphonostomata ...	209	53	8	19	289
Gasteropoda { Holostomata	83	45	6	13	147
Gasteropoda { Opistho-branchiata ...	9	1	0	2	12
Pteropoda	3	0	0	0	3
Brachiopoda	10	0	1	0	11
Lamellibranchiata	69	43	15	1	128
Total	386	142	30	35	593

Digitized by Google

II. List of Mollusca found in the Muddy Crfek beds.

O, older (lower) beds; Y, younger (upper) beds; ?, O or Y (column 4 of summary).

Beds in which found.	Name of Species.
	CEPHALOPODA.
O	Sepia sp.
O	Aturia australis, *McCoy*
O	Nautilus sp.
	GASTEROPODA.
O	Typhis McCoyii, *T. Woods*
O	disjunctus, *Tate*
O	laciniatus, *Tate*
O	evaricosus, *Tate*
O	Murex velificus, *Tate*
Y	trinodosus, *Tate*
O	didymus, *Tate*
O	lophœssus, *Tate*
O	Dennanti, *Tate*
O	amblyceras, *Tate*
O	irregularis, *Tate*
O	Hamiltonensis, *Tate*
O	asteriscus, *Tate*
O	pachystirus, *Tate*
O	Eyrei, *T. Woods*
O Y	trochispira, *Tate*
O	alveolatus, *Tate*
Y	crassiliratus, *Tate*
?	camplytropis, *Tate*
O	asperulus, *Tate*
O	Trophon polyphyllus, *T. Woods*
O	brevicaudatus, *Tate*
Y	sp.
O	Rapana aculeata, *Tate*
O	Vitularia curtansata, *Tate*
Y	Ricinula subreticulata, *Tate*
Y	Purpura abjecta, *Tate*
O	Ranella Prattii, *T. Woods*
Y	Triton ovoideus, *Tate*
O	Woodsii, *Tate*
O	gibbus, *Tate*
O	cyphus, *Tate*
O	textilis, *Tate*
O	intercostalis, *Tate*
O	annectans, *Tate*
O	protensus, *Tate*

Digitized by Google

Beds in which found.	Name of Species.
O	Triton tumulosus, *Tate*
O	tortirostris, *Tate*
O	gemmulatus, *Tate*
Y	Quoyi, *Reeve*
O	Epidromus tenuicostatus, *T. Woods*
?	leptoskeles, *Tate*
?	citharellus, *Tate*
O	texturatus, *Tate*
O	turritus, *Tate*
O	Fusus bulbodes, *Tate*
O	aciformis, *Tate*
O	hexagonalis, *Tate*
Y	dumetosus, *Tate*
O	dictyotis, *Tate*
O	simulans, *Tate*
O	foliaceus, *Tate*
O	acanthostephes, *Tate*
O	craspedotus, *Tate*
O	senticosus, *Tate*
O	henicus, *Tate*
O	Fasciolaria Tenisoni, *T. Woods*
O	exilis, *Tate*
O	decipiens, *Tate*
?	cristata, *Tate*
O	cryptoploca, *Tate*
O	rugata, *Tate*
O	fusilla, *Tate*
O	Peristernia lintea, *Tate*
Y	approximans, *Tate*
O	succincta, *T. Woods*
Y	purpuroides, *Tate*
O	interlineata, *Tate*
O	subundulosa, *Tate*
O	Sipho labrosus, *Tate*
O	crebrigranosus, *Tate*
O	asperulus, *Tate*
O	styliformis, *T. Woods*
O	Pseudovaricia mirabilis, *Tate*
O	Siphonalia subreflexa, *Tate*
O	longirostris, *Tate*
Y	spatiosa, *Tate*
Y	sp.
?	sp.
O	Tudicula turbinata, *Tate*
O	angulata, *Tate*

Digitized by Google

Beds in which found.	Name of Species.
O	Dennantia Ino, *T. Woods*
Y	Pisania rostrata, *Tate*
Y	semicostata
Y	obliquecostata, *Tate*
O Y	brevis, *Tate*
O	purpuroides, *Johnston*
Y	Cominella crassina, *Tate*
O	Eburna aulocessa, *Tate*,
O	Zemira præcursoria, *Tate*
O	Phos variciferus, *Tate*
?	tardicrescens, *Tate*
Y	tuberculatus, *Tate*
O	cominelloides, *Tate*
O	Nassa Tatei, *T. Woods*
Y	crassigranosa, *Tate*
Y	sublirella, *Tate*
O	Voluta antiscalaris, *McCoy*
O	sarissa, *Tate*
O	McCoyii, *T. Woods*
Y	Masoni, *Tate*
O	Hannafordi, *McCoy*
O	McDonaldi, *Tate*
O	strophodon, *McCoy*
O	Weldii, *T. Woods*
O	costellifera, *Tate*
O	Mortoni, *Tate*
O	ancilloides, *Tate*
O	pseudolirata, *Tate*
O	crassilabra, *Tate*
O	lirata, *Johnston*
O	alticostata, *Tate*
O	conoidea, *Tate*
O	ellipsoidea, *Tate*
O	cathedralis, *Tate*
O	polita, *Tate*
O	Lyria harpularia, *Tate*
Y	gemmata, *Tate*
O	Mitra alokiza, *T. Woods*
O	dictua, *T. Woods*
O	Dennanti, *Tate*
Y	atypha, *Tate*
O	ligata, *Tate*
Y	conoidalis, *Tate*
O	atractoides, *Tate*
O	exilis, *Tate*

Digitized by Google

Beds in which found.	Name of Species.
O	Mitra semilævis, *Tate*
O	clathurella, *Tate*
O	paucicostata, *Tate*
O	escharoides, *Tate*
O	biornata, *Tate*
O	leptalea, *Tate*
O Y	terebræformis, *Tate*
O	othone, *T. Woods*
Y	cassida, *Tate*
Y	sordida, *Tate*
O	Marginella Woodsii, *Tate*
O	propinqua, *Tate*
O	Winteri, *Tate*
Y	muscaroides, *Tate*
Y	*aff.* ovulum, *Sow.*
O	micula, *Tate*
O	inermis, *Tate*
O	Wentworthi, *T. Woods*
O	cassidiformis, *Tate*
O	septemplicata, *Tate*
Y	sp.
O Y	sp.
O	Erato minor, *Tate*
O	Oliva angustata, *Tate*
Y	nymphalis, *Tate*
Y	Ancillaria papillata, *Tate*
O Y	pseudaustralis, *Tate*
O	sublævis, *T. Woods*
O	heberæ, *Hutton*
O	lanceolata, *Tate*
O	ampliata, *Tate*
O	Harpa lamellifera, *Tate*
O	tenuis, *Tate*
O	abbreviata, *Tate*
O	sulcosa, *Tate*
Y	Columbella bidens, *Tate, m.s.*
Y	fenestrata, *Tate, m.s.*
Y	vexans, *Tate, m.s.*
Y	tridens, *Tate, m.s.*
O	infans, *Tate, m.s.*
Y	pachychila, *Tate, m.s.*
O	cochleata, *Tate, m.s.*
O	cingulata, *Tate, m.s.*
O	nodulosa, *Tate, m.s.*
Y	unicarinata, *Tate, m.s.*

Digitized by Google

Beds in which found.	Name of Species.
O Y	Columbella atratæformis, *Tate, m.s.*
O	subspeciosa, *Tate, m.s.*
Y	cainozoica, *T. Woods*
O	semicostata, *T. Woods*
Y	Oxleyi, *T. Woods*
O	funiculata, *T. Woods*
O	clathrata, *Tate, m.s.*
O	oryza, *Tate, m.s.*
O	aciculata, *Tate, m.s.*
O	oligostira, *Tate, m.s.*
O	crebricostata, *T. Woods*
Y	bicarinata, *Tate, m.s.*
O	cominelloides, *Tate, m.s.*
Y	exoptata, *Tate, m.s.*
O	septemcostata, *Tate, m.s.*
O	Cancellaria epidromiformis, *Tate*
O	varicifera, *T. Woods*
O	laticostata, *T. Woods*
O	pseudaustralis, *Tate*
O	semicostata, *Tate*
O	capillata, *Tate*
O	gradata, *Tate*
Y	Wannonensis, *Tate*
Y	modestina, *Tate*
O	Trichotropis sp.
O	Pusionella hemiothone, *Tate, m.s.*
Y	Terebra catenifera, *Tate*
O	platyspira, *Tate*
O	simplex, *T. Woods*
Y	geniculata, *Tate*
Y	subspectabilis, *Tate*
Y	additoides, *T. Woods?*
O	truncata, *Tate*
O	Pleurotoma perarata, *Tate, m.s.*
O	Murndaliana, *T. Woods*
O	Haastii, *Hutton*
O	Claræ, *T. Woods*
?	hemipsila, *Tate, m.s.*
O	consutilis, *T. Woods*
O	Samueli, *T. Woods*
?	rhomboidalis, *T. Woods*
O	paracantha, *T. Woods*
O	Johnstoni, *T. Woods*
O	sp.
O Y	Drillia Trevori, *T. Woods*

Digitized by Google

Beds in which found.	Name of Species.
Y	Drillia columba, *Tate, m.s.*
?	stiza, *T. Woods*
O	integra, *T. Woods*
O	five species
Y	sp.
?	sp.
O	Mangelia bidens, *T. Woods*
O	six species
Y	sp.
?	three species
O	Bela sculptilis, *Tate*
O	pulchra, *Tate*
O	crassilirata, *Tate*
O	cancellata, *T. Woods*
O	Clavatula fusilla, *Tate, m.s.*
O	asperula, *Tate, m.s.*
O	texturata, *Tate, m.s.*
?	Clathurella sp.
O	two species
Y	sp.
O	Daphnella tenuisculpta, *T. Woods*
O	gracillima, *T. Woods*
?	fragilis, *Tate, m.s.*
O	(*aff.* gracillima)
?	inornata, *Tate, m.s.*
O	two species
Y	Borsonia marginata, *T. Woods* (Thala)
O	Raphitoma daphnelloides, *T. Woods* (Mitra)
O	Conus papillosus, *Tate, m.s.*
?	ptychodermis, *Tate, m.s.*
?	complicatus, *Tate, m.s.*
O	pullulescens, *T. Woods*
O Y	Hamiltonensis, *Tate, m.s.*
O	Ralphii, *T. Woods*
O	scalaris, *Tate, m.s.*
O	(*aff.* Hamiltonensis)
O	(*aff.* papillosus)
O	(*aff.* pullulescens)
O	Cypræa eximia, *McCoy*
O	gigas, *McCoy*
O	platypiga, *McCoy*
O	contusa, *McCoy*
O	leptorhyncha, *McCoy*
O	platyrhyncha, *McCoy*
O	Murraviana, *Tate, m.s.*

Digitized by Google

Beds in which found.	Name of Species.
Y	Cypræa Archeri, *T. Woods*
O	dorsata, *Tate, m.s.*
O	six species
O	Trivia avellanoides, *McCoy*
O	sp.
O	Cassis exigua, *T. Woods*
O	Semicassis transenna, *Tate*
Y	Muelleri, *Tate*
?	sufflata, *T. Woods*
O	Cassidaria gradata, *Tate*
O Y	Natica auriculata, *Tate, m.s.*
?	Wintlei, *T. Woods*
O	perspectiva, *Tate, m.s.*
O Y	gibbosa, *Hutton*
O	limata, *Tate, m.s.*
O	Hamiltonensis, *T. Woods*
O	polita, *T. Woods*
O	paludinæformis, *Tate, m.s.*
Y	Trochita calyptræformis, *T. Woods*
O Y	rhysa, *Tate, m.s.*
Y	Crepidula (*aff.* C. unguis, *Lam.*)
Y	sp.
O	Capulus turbinata, *T. Woods*
O	Hipponyx foliaceus, *Q. and G.*
Y	Amalthea conica, *Schum.*
O	Astele sp.
Y	Zizyphinus sp.
O	two species
O	Euchelus sp.
Y	sp.
O	Xenophora agglutinans, *Lam.*
O	Solarium acutum, *T. Woods*
O	ephamilla, *Tate*
O	Wannonensis, *T. Woods*
Y	Scalaria triplicata, *Tate, m.s.*
O	seven species
O	Cirsotrema, three species
Y	sp.
O	Crossea parvula, *T. Woods*
O	sp.
O Y	Turritella platyspira, *T. Woods*
O	sp.
?	sp.
Y	Mesalia sp.
O	Torcula Murrayana, *Tate*

Digitized by Google

Beds in which found.	Name of Species.
O	Siliquaria squamulifera, *Tate, m.s.*
O	Eulima Danæ, *T. Woods*
O	two species
O	Niso psila, *T. Woods*
?	Turbonilla (*cf.* T. Hoffmanni)
O	Actæopyramis sp.
Y	Pyramidella tridens, *Tate, m.s.*
Y	nisoformis, *Tate, m.s.*
Y	three species
O	sp.
Y	Odostomia curta, *Tate, m.s.*
O	two speeies
Y	two species
Y	Planaxis (*cf.* P. mollis)
Y	Pelicaria coronata, *Tate*
O	Cerithium apheles, *T. Woods*
O	eusmilia, *T. Woods*
O	crebarioides, *T. Woods*
O	Salteriana, *T. Woods*
Y	two species
O	Cerithiopsis, two species
O	Triforis Wilkinsoni, *T, Woods*
O	sulcata, *T. Woods*
O	planata, *T. Woods*
Y	Lampania rubricata, *Tate, m.s.*
Y	Rissoa chrysalida, *Tate, m.s.*
Y	two species
Y	Rissoina punctifera, *Tate, m.s.*
Y	two species
Y	Nerita melanotragus, *Smith*
O	Leiostraca Johnstoniana, *Tate*
O	Mathilda, two species
O	Astralium Flindersi, *T. Woods* ?
Y	Diloma crassilirata, *Tate, m.s.*
O	Liotia Roblini, *T. Woods*
O	two species
?	Cyclostrema carinata, *T. Woods*
O	sp.
Y	Phasianella, three species
?	Gibbula æquisulcata, *T. Woods*
O	Collonia infralineata, *Tate, m.s.*
Y	Clanculus princeps, *Tate, m.s.*
Y	Dennanti, *Tate, m.s.*
Y	sp.
Y	Trochocochlea antiqua, *Tate, m.s.*

Digitized by Google

Beds in which found.	Name of Species
O	Minolia strigata, *T. Woods*
O	sp.
O	Thalotia exigua, *T. Woods*
?	Elenchus sp.
O	Cantharidus, three species
O	Diala bulimoides, *Tate, m.s.*
Y	Turbo paucigranosa, *Tate*
Y	Etheridgei, *T. Woods*
Y	Eligmope Dennanti, *Tate, m.s.*
Y	Leiopyrga cingulata, *Tate, m.s.*
O	Trochus, eight species
Y	sp.
?	three species
O	Delphinula aster, *T. Woods*
Y	Haliotis nævosoides, *McCoy*
Y	Fissurella nigrita, *Gray*
O	malleata, *Tate*
O	Hemitoma occlusa, *Tate, m.s.*
O	Emarginula candida, *Tate, m.s.*
?	transenna, *Tate, m.s.*
O	cymbium, *Tate, m.s.*
O	Acmæa, two species
?	sp.
Y	Siphonaria, sp.
O	Chiton, sp.
O Y	Entalis annulatum, *Tate*
O Y	Mantelli, *Zittel*
O	acriculum, *Tate*
O	subfissura, *Tate*
?	Dentalium bifrons, *Tate*
O	aratum, *Tate*
?	lacteum, *Deshayes*
O	Cadulus mucronatus, *Tate*
O	Scaphander fragilis, *Tate, m.s.*
O	Tornatella scrobiculata, *T. Woods*
O	biornata, *Tate, m.s.*
?	Tornatina, two species
Y	Volvula, sp.
O	Ringuicula lactea, *Johnston*
O	Cylichna exigua, *T. Woods*
O	three species
O	Umbrella austrina, *Tate, m.s.*
	PTEROPODA.
O	Styliola Rangiana, *Tate*
O	Spiralis tertiaria, *Tate*
O	Vaginella eligmostoma, *Tate*

Digitized by Google

Beds in which found.	Name of Species.
	BRACHIOPODA.
O	Terebratula vitreoides, *T. Woods*
O	Waldheimia insolita, *Tate*
O	Tateana, *T. Woods*
O	Garibaldiana, *Davidson*
O	Corioensis, *McCoy*
O	Magasella compta, *Sow.*
O Y	Magasella Woodsiana, *Tate*
O	Terebratulina Scoulari, *Tate*
O	Davidsoni, *Etheridge*
O	Thecidium australe, *Tate*
O	Rhynchonella squamosa, *Hutton*
	LAMELLIBRANCHIATA
O	Ostrea hyotis, *Linn.*
Y	manubriata, *Tate*
O	Dimya dissimilis, *Tate*
Y	Placunanomia Ione, *Gray*
O	sella, *Tate*
O	Pecten Murrayanus, *Tate*
O Y	Sturtianus, *Tate*
O	Yahlensis, *T. Woods*
O	Foulcheri, *T. Woods*
O	polymorphoides, *Zittel*
O	Zitteli, *Hutton*
O	deformis, *Tate*
Y	subconvexus, *Tate*
O	Lima Bassii, *T. Woods*
O	linguliformis, *Tate*
O	Jeffreysiana, *Tate*
O	Limea transenna, *Tate*
O	Spondylus pseudo-radula, *McCoy*
O	Plicatula, sp.
O	Meleagrina crassicardia, *Tate*
Y	Perna, sp.
O	Pinna, sp.
Y	Mytilus Hamiltonensis, *Tate*
Y	linguatulus, *Tate*
Y	deperditus, *Tate*
O	Septifer fenestratus, *Tate*
O Y	Modiolaria singularis, *Tate*
O	Crenella globularis, *Tate*
Y	Nucula tumida, *T. Woods*
O	Atkinsoni, *Johnston*
O	Morundiana, *Tate*
O	Leda obolella, *Tate*

Digitized by Google

Beds in which found.	Name of Species.
O	Leda Huttoni, *T. Woods*
Y	acinaciformis, *Tate*
O	vagans, *Tate*
Y	prælonga, *Tate*
O Y	Woodsii, *Tate*
O Y	Limopsis aurita, *Brocchi*
O Y	Belcheri, *Adams & Reeve*
O Y	Pectunculus cainozoicus, *T. Woods*
O Y	McCoyii, *Johnston*
?	subtrigonalis, *Tate*
Y	convexus, *Tate*
O	Barbatia crustata, *Tate*
O Y	celleporacea, *Tate*
O Y	consutilis, *Tate*
O	simulans, *Tate*
O	pumila, *Tate*
O	Macrodon cainozoicus, *Tate*
O Y	Cucullæa Corioensis, *McCoy*
O	Trigonia semiundulata, *McCoy*
O	tubulifera, *Tate*
Y	acuticostata, *McCoy*
Y.	Howitti, *McCoy*
Y	Crassatella oblonga, *T. Woods*
O	Dennanti, *Tate*
O	astartiformis, *Tate*
Y	Carditella polita, *Tate*
O	multilamella, *Tate*
Y	Mytilicardia compta, *Tate*
Y	Cardita pecten, *Tate*
O	compacta, *Tate*
O Y	scabrosa, *Tate*
O	gracilicostata, *T. Woods*
O	delicatula, *Tate*
Y	solida, *Tate*
Y	calva, *Tate*
O	Lucina leucomomorpha, *Tate*
O	projecta, *Tate*
O	araneosa, *Tate*
O	despectans, *Tate*
O	Cryptodon mactræformis, *Tate*
O	Diplodonta subquadrata, *Tate*
O	Sacchia suborbicularis, *Tate*
O	crepidulæformis, *Tate, m.s.*
Y	Kellia micans, *Tate*
Y	Pythina, sp.

Digitized by Google

Beds in which found.	Name of Species.
O Y	Montacuta sericea, *Tate*
O	Chama lamellifera, *T. Woods*
Y	Chamostrea albida, *Lam.*
O	Verticordia pectinata, *Tate*
O	Cardium Victoriæ, *Tate*
O	cuculloides, *Tate*
O	antisemigranulatum, *McCoy*
O	hemimeris, *Tate*
O	Chione dimorphophylla, *Tate*
O	cainozoica, *T. Woods*
Y	subroborata, *Tate*
O Y	propinqua, *T. Woods*
Y	Cytherea paucirugata, *Tate*
O	eburnea, *Tate*
Y	submultistriata, *Tate*
Y	Dosinia Johnstoni, *Tate*
Y	Meroë gibberula, *Tate*
Y	Tapes sp.
Y	Venerupis paupertina, *Tate*
Y	Tellina albinelloides, *Tate*
O	Masoni, *Tate*
Y	æquilatera, *Tate*
O	Stirlingi, *Tate*
Y	(*aff.* Arcopagia decussata)
Y	Strigilla australis, *Tate*
Y	Psammobia Hamiltonensis, *Tate*
O Y	æqualis, *Tate*
O	Donax Dixoni, *Tate*
O	Semele vesiculosa, *Tate*
O	Krauseana, *Tate*
Y	Mactra axiniformis, *Tate*
Y	Hamiltonensis, *Tate*
O	Howchiniana, *Tate*
Y	Zenatiopsis angustata, *Tate*
O	Thracia perscabrosa, *Tate*
Y	Myodora prælonga, *Tate*
Y	angustior, *Tate*
O	tenuilirata, *Tate*
O	australis, *Johnston*
Y	corrugata, *Tate*
Y	æquilateralis, *Johnston*
O	sp.
O Y	Corbula ephamilla, *Tate*
O	Neæra subrostrata, *Tate*
O	Panopæa orbita, *Hutton*

Digitized by Google

Beds in which found.	Name of Species.
Y	Solen sordidus, *Tate*
O	Solecurtus Dennanti, *Tate*
Y	Barnea tiara, *Tate*
O	Teredo Heaphyi, *Zittel*
O	Humphreyia lirata, *Tate*
O	Saxicava arctica, *Linn.*

A few fossils, abundant in the lower zone, but only known in the upper by an occasional rolled and worn example, are, I think, derived forms, and they have not therefore been noted in the above list as belonging to both beds, At the actual junction of the beds, owing probably to a partial reconstruction of the strata, there is for a small space, both above and below the nodule band, a slight intermingling of the characteristic species of the two zones. This is not noticeable with the larger shells, but was observed to be the case for the smaller forms by Professor Tate, when examining some parcels of fossiliferous earth, which I forwarded to him a few months ago. Professor Tate gives the following as the result of his siftings of the earth sent :—

"Working at the gatherings from the two beds I have so far found the following species in common :—

I. *Characteristic fossils of the upper bed passing down into the top of the lower series.*

Chione subroborata, small and rare.
propinqua, small and rare.
Pectunculus convexus, small and very rare.
Placunanomia Ione, small and very rare.
Marginella muscaroides, rare.
Leiopyrga cingulata, common but small.
Montacuta sericea, one perfect valve.
Rissoa, sp.

The following are doubtful constituents of the fauna :—

Ancillaria papillata, one rolled fragment.
Terebra geniculata, two rolled examples.
Phasianella, both species, rolled one of each.
Columbella tridens, one rolled.
Rissoina sp., one rolled.
Tellina æquilatera, one fragment.
Psammobia Hamiltonensis, one fragment.
Barnea tiara, one fragment.

II. *Fossils of the lower series passing to the upper series.*

Sacchia suborbicularis, one example, small.
Lucina despectans, one example, small.
Erato minor, several examples, worn.

Digitized by Google

Marginella propinqua, two broken and worn.
Natica polita, one worn.
Marginella Woodsii, one worn.
Oliva angustata, a rolled fragment.
Terebratulina Davidsoni, many, but all worn.

I am much inclined to reject those species which I have met with only rarely and in a rolled condition. . . Certainly the majority of the fossils obtained under the nodule band belongs to the lower fauna."

Amongst the nodules and bone remains, perfect examples of some of the stronger shells belonging to the upper beds are abundant, *e.g.*, *Crassatella oblonga*, *Chione subroborata*, *Natica gibbosa*, *Pectunculus convexus*, &c. Fragile shells are absent, though they are plentiful enough in the strata above. Lower-bed shells have not been noticed in the nodule band, which would seem to indicate that this was laid down, not when the deposition of the older beds ceased, but when that of the younger ones commenced. As said before, the beds both above and below the nodules are horizontal, so that there is here simply a gap in the succession of the tertiary strata.

A much larger number of species occur in the lower than in the upper beds, especially amongst the siphonostomatous univalves, while the brachiopoda are almost confined to them. It is generally admitted that their fossils could only have lived in seas warmer than those of the present coasts of Southern Australia. On the other hand, the shells of the upper beds indicate a nearer approach to the existing temperature of our waters. Bivalves and holostomatous univalves predominate in them, and though, as compared with the lower beds, the number of species is small, individual examples are usually more abundant. Omitting for the present the shells referred to in column 4 of the summary, the total number of species recognised in the lower beds is 416, and in the upper 174. Of these, 81 species in the lower, and 37 in the upper beds have not been fully examined. By deducting them, we get 335 species belonging to the lower, and 137 to the upper zone, which have received distinctive names, and which may therefore be regarded as authenticated species. In the lower beds five living species are known, viz. :—

Ostrea hyotis, *Linn.*
Limopsis aurita, *Brocchi*
Belcheri, *Ad. & R.*
Saxicava arctica, *Linn.*
Hipponyx foliaceus, *Q. & G.*

The percentage of recent to extinct forms is thus only 1·5, which would place the beds low down in the eocene division of the tertiaries.

Digitized by Google

In the upper beds the existing species amount to nine, eight of which are found in the Australian seas, viz. :—

Triton Quoyi, *Reeve*
Placunanomia Ione, *Gray*
Limopsis aurita, *Brocchi*
Belcheri, *Ad. & R.*
Trigonia acuticostata, *McCoy*
Chamostrea albida, *Lam.*
Nerita melanotragus, *Smith*
Fissurella nigrita, *Sow.*
Amalthea conica, *Schum.*

The percentage of recent shells in these beds is therefore only 6·5. which would assign them to the oligocene period. I doubt, however, if the percentage system of classification can be safely applied to either set of beds, while so many forms remain undescribed. In the lower zone nummulites occur, and its eocene character may possibly be confirmed by further exploration.

The geological age of the upper beds cannot well be estimated at present, since many species of mollusca obtained from them have yet to be critically examined. The general character of the shells is certainly against their belonging to so early an epoch as the oligocene, and I think it improbable that they are older than miocene. In the case of several, which have received distinctive names, their affinity to existing species is so great that hesitation is felt by palæontologists in separating them. In the following table, a list is given of the fossil and living species which are most closely allied. For fuller information the reader is referred to Professor Tate's description of the shells.*

Species Fossil in Upper Beds.	Living Analogues.
Murex trinodosus	M. Angasi, *Crosse*
Ricinula subreticulata	Purpura reticulata, *Q. & G.*
Purpura abjecta	P. textilosa, *Lam.*
Triton ovoideus	T. Bassii, *Angas*
Peristernia approximans	Trophon Paivæ, *Crosse*
Marginella sp.	M. ovulum, *Sow.*
Nassa sub lirella	N. lirella, *Beck*
Pecten subconvexus	P. convexus, *Q. and G.*
Mytilus Hamiltonensis	M. hirsutus, *Lam.*
deperditus	M. chorus, *Molina*
Cardita solida	C. bimaculata, *Deshayes*
Leda acinaciformis	L. crassa, *Hinds*
Mytilicardia compta	M. crassicostata, *Lam.*
Chione subroborata	C. roborata, *Hanley*
Meroë gibberula	M. Aliciæ, *Angas*
Venerupis paupertina	V. exotica, *Lam.*
Tellina albinelloides	T. albinella, *Lam.*
Cytherea paucirugata	C. rutila, *Hanley*

* Transactions Royal Society of South Australia, 1885-6-7.

Digitized by Google

Mactra Hamiltonensis	M. polita, *Chem.*
Solen sordidus	S. Sloanii, *Gray*
Barnea tiara	B. australasiæ, *Gray*
Terebra subspectabilis	T. spectabilis, *Hinds*
additoides	T. ustulata, *Deshayes*
Crepidula sp.	C. unguis, *Lam.*
Planaxis sp.	P. mollis, *Sow.*

It will be necessary here, for the sake of comparison, to refer briefly to some of the other marine tertiary deposits of Victoria.

On the shores of Port Phillip Bay, outcrops of such strata occur, amongst other places, at Mornington, between Mount Eliza and Mount Martha, and at Mordialloc, and fossils from both localities have been described by Professor McCoy in the Prodromus of Victorian Palæontology. As far as can be judged from the comparatively small number of species yet recorded, the deposits of Mornington are represented in the lower, and those of Mordialloc in the upper Muddy Creek beds.

At Portland Bay, and also on the Glenelg River, two sets of strata are exposed, viz., a lower one composed of friable limestone, in which brachiopods, echinodermata, and foraminifera are the prevailing fossils, and an upper one consisting almost entirely of oyster shells. Concerning the age of the former of these there is considerable difference of opinion amongst geologists, some contending that it is older than the Muddy Creek beds, while others regard it as younger.

The upper deposit, or ostrea limestone, has been noticed as a surface formation at various places, not only near the coast, but also for some distance inland, and it must at one time have extended over a wide area. The most interesting outcrop of it known to me is at the Whaler's Bluff, Portland, where its junction with the older formation is clearly seen. Rising from the water's edge, the latter, easily recognisable by the fossils it contains, reaches about 40 feet up the cliff, when the ostrea limestone appears resting upon it. This extends for the next 12 or 15 feet, and is there overlain by igneous rocks, which continue up to the summit of the cliff, a height of about 100 feet.

While exploring here a few months ago, I made the curious discovery that the two sets of strata are actually separated by a pebble band of a few inches in thickness, horizontally disposed, and distinctly traceable, not only on this cliff, but also on an adjoining one. The pebbles vary in size from a diameter of about one and a half inches to that of a few lines only. They are of a light-brown colour, and very irregular in shape, some being nearly circular, some flattened, and some elongated; the edges of all are, however, more or less rounded, from which it may be concluded that they are rolled fragments, just as the nodules at Muddy

Digitized by Google

Creek are. Their percentage composition is not uniform, but lime, alumina, iron, silica, and carbon dioxide, were found in all, though in varying proportions in different samples analysed. They differ from the Muddy Creek nodules in containing a smaller amount of iron and no phosphoric acid. Although the pebble bands of Muddy Creek and Portland Bay are thus in some respects unlike, they, nevertheless, mark a distinct break in the succession of the strata at both places.

The most abundant fossil in the Ostrea limestone is *Ostrea arenicola* (Tate), which is closely allied to *O. Angasi*, a living species. In addition, I have collected the following, chiefly from the exposures of the strata on the Glenelg cliffs :—*Pecten meridionalis* (Tate), *Mytilus chorus* (Molina), *Chthalamus stellatus* (Poli), *Placunanomia Ione* (Gray), *Zenatiopsis angustata* (Tate), of which all but the last are living species. The Ostrea limestone must either belong to the late miocene or early pliocene period, probably the latter, the next older formation being, I think, the upper Muddy Creek beds.

III. Associated Rocks and Thickness of Strata.

As mentioned in the introduction, we do not know what formation the great body of the tertiaries in south-western Victoria rests upon. Even at Muddy Creek, which cannot be far from their northern boundary, the fossiliferous beds have not been pierced, and what underlies them has yet to be discovered. A few years ago, two energetic fossil hunters determined to solve this question by sinking a shaft in the bed of the creek. Unfortunately, their geological knowledge was not equal to their enthusiasm, as they chose a spot quite near the top of the upper beds, so that though they went down a good distance, they never even reached the lower beds, many feet of which are exposed in natural section on the banks of the stream, a few chains farther down. I would venture to suggest that the work of piercing such important beds as these should be undertaken by the Survey Department of Victoria. Whether boring operations here, and in the neighbourhood, would be likely to lead to discoveries, which could be turned to profitable use or not, I cannot say, but the scientific value of the information gained would be great. I had some grounds for thinking, at one time, that the expense of sinking a shaft would be defrayed by the Ballarat School of Mines, a proposal to that effect having been at first very favourably received. In the end, however, other counsels prevailed, and it was decided that no funds were available for such a purpose.

It is true that, at many places on the Grange Burn, certain rocks appear just beneath the tertiaries, but they are of igneous origin, and have penetrated through some earlier sedimentary

Digitized by Google

formation. Lithologically, they are a quartz-felspar porphyry, consisting of a felspathic matrix, enclosing well-developed crystals of quartz and orthoclase. From the presence of these, the rocks have a characteristic speckled appearance, which is very marked on the surface of a fresh fracture. Their colour is various, the matrix and the porphyritic felspar ranging from white to a reddish-brown; the quartz is usually black when looked at in the mass of the rock, but in a microscopic slide it appears beautifully transparent, and polarizes with the most vivid hues. Orthoclase is the only felspar present, no plagioclase having been found in any slice prepared. In structure the rock is eminently prismatic. This is very plainly shown in several sections, but especially at the spot marked "*d*" on the map, where a series of nearly perpendicular, though short, columns extends right across the stream. At the margin of the bank, on either side, the porphyry is overlain by about 10 or 12 feet of the polyzoal rock, the junction of the two formations being very clearly marked, on account of their totally different character. The outline of the country in this place is irregular, and I am inclined to think that there must have been a trough or narrow depression in the porphyry before the deposition of the tertiary strata upon it. Resting upon the polyzoal rock is the basalt, and the stream, having cut its way through the two uppermost formations, has exposed the underlying trap, which now forms the bed of the creek. Higher up the stream, the upper beds lie immediately upon it, and fragments of the rock are occasionally unearthed when digging for fossils. These porphyries are unknown anywhere to the south of the Grange Burn, but they can be traced in a north-easterly direction from it for fully 30 miles. The width of the outcrop varies, but in the neighbourhood of the tertiaries the rock is seen only in the Grange Burn, there being no sign of it in any part of Muddy Creek, neither *in situ* nor as fragments among the fossil deposits. It is unlikely, therefore, that the porphyry would be met with in sinking below the bed of the last-named stream, and the question as to what the underlying formation really is has yet to be solved.

The presence of the porphyry aids in determining the thickness of the upper beds. As the Grange Burn is followed upwards, a point is reached where this rock just ceases to be covered by the tertiaries, the basalt instead resting immediately upon it. The elevation of this spot is 450 feet above sea level, and, therefore, 40 feet higher than the nodule band at the base of the upper zone.

No estimate can be formed as to the thickness of the remaining portions of the tertiary series, viz., the lower beds of Muddy Creek, the polyzoal rock, and the Portland beds. Near the top

Digitized by Google

of Mount Eckersley, at an elevation of 319 feet (see section, fig. 2), there is an outcrop of limestone, which I take to be an outlier of the Portland beds. By adding this height to the depth of the Heywood bore, 190 feet below sea level, we get a vertical thickness of 509 feet, but as the base of the formation is not then reached, it is impossible to say how much lower the strata extend.

The Muddy Creek tertiaries, and, for the most part, those to the south of them, right down to the sea coast, are overlain by basaltic rocks. On the Glenelg, and in the country to the west of it, these are absent, and the tertiaries there are sometimes seen on the surface, though they are usually covered by drift sand.

Many of the vents, through which the lava sheets have issued, are still represented by volcanic cones of moderate height, as Mounts Bainbridge, Pierrepoint, Napier, Eccles, Eckersley, &c.

The Portland Bay beds were probably covered by an outflow from the extinct crater at Cape Bridgewater. Some of the lava overlying the Muddy Creek beds may have come from either Mount Bainbridge or Mount Pierrepoint, extinct volcanoes about seven miles distant. A portion of it, however, was probably ejected closer at hand. Mention has before been made of the miniature falls over which the Muddy Creek flows, just before its junction with the Grange Burn. Here massive basaltic rocks extend right across the stream, completely concealing the fossiliferous strata, which do not appear again till the junction is passed. A few chains from the falls, on the north side of the creek, there is a low conical hill, with a ring of basaltic boulders surrounding it, and there can be but little doubt as to this being the spot from which the lava in the immediate vicinity proceeded.

Wherever seen, from Portland to the foot of the Serra Range, the basalt is essentially the same rock, viz., a true dolerite, with olivine, triclinic felspar, and augite as its chief constituents.

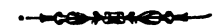
The age of this rock is, I am aware, a moot point, some assigning it to the pliocene and others to the pleistocene period. I prefer to regard it as not older than pleistocene, for the following reasons :—

1. The lava flows from Mounts Napier and Eccles are even now most striking features of the landscape, looking like rivers of stone, as they wind along over miles of country, till they reach the sea coast, while the rocks still present such sharp angles that to attempt to walk over them would cut the stoutest boots to pieces in a few hours. Even supposing these to be of later date than the others mentioned, the difference of age cannot be great, tertiary fossils being alike found under all the basalt from Portland Bay to Muddy Creek.

Digitized by Google

2. The lava stream from Mount Eccles is, towards its termination, but little raised above sea level, and, as it is unmistakeably a subaërial flow, it must have been poured forth when the land stood at nearly its present height. Now, the gradual upheaval of the southern coast of Victoria in late geological times is proved by the presence of "raised beaches" of early pleistocene (or possibly late pliocene) age on the Glenelg at Limestone Creek, a description of which has been given by me,* and, as they were deposited when the land stood from 75 to 100 feet lower than now, it follows that the Mount Eccles overflow was a subsequent event, and could not therefore have taken place earlier than the pleistocene period.

3. The only deposit which can be identified as younger than the basalt is the dune limestone of Nelson Bay and neighbouring localities, and this, from its being still in course of formation, as well as from other evidence,† must be considered as recent. Immediately beneath it lies the basalt, which is, in all probability, the next older formation.



* Post Tertiary Strata of South-Western Victoria, Transactions Royal Society of Victoria, vol. xxiii. † *Ibid.*

Digitized by Google

Descriptions of some New Species of Marine Mollusca from South Australia and Victoria.

By Professor Ralph Tate, F.L.S., F.G.S.

[Read October 2nd, 1888.]

Plate XI.

Teredo fragilis, *spec. nov.* Plate xi., figs. 13*a*—13*c*.

Tube fragile, slender, simple, constricted at frequent intervals, but not septated internally; siphonal end incompletely divided lengthwise. The shell offers no distinctive character.

Animal with united siphons, furnished with two small shelly clavate pallets, the stalk much attenuated, the enlarged somewhat compressed upper portion crowned with a cartilaginous crust, which has a projecting horn at each end.

Dimensions.—Length, 65; diameter of circular aperture, 4·25 millimetres.

Locality.—Burrowing with the grain of the wood of the wharf-piles at Port Adelaide.

Coelodon patulus, *spec. nov.* Plate xi., fig. 1.

Shell thin, pellucid-white, compressed, inequilateral, inequivalve; right valve slightly convex, left valve flat in the dorsal region, concave ventrally. Anterior side short, subacutely rounded; posterior side prolonged, patulously extended ventrally, truncated. Post-dorsal line nearly straight, or slightly incurved, bounded by a slightly depressed linear-lanceolate area. Umbo depressed, rather acute, situated in the anterior one-fifth. Surface distinctly concentrically wrinkled.

Dimensions.—Antero-posterior diameter, 16·5; dorso-ventral diameter, 9·5; sectional diameter of both valves, 1 millimetre.

Localities.—Dredged in life from 10 fathoms at Wool Bay, St. Vincent Gulf (McDougall and Matthews); dead shells dredged from deep water, Investigator Straits (South Australian Museum).

If *Pandora trilineata*, Reeve, from Ceylon, be a *Coelodon*, the present shell may have to be referred to it, as the only external differential characters are a slightly different shape (a straighter hinge line and a more acute posterior margin) and the absence of a nodulose dorsal rib.

Mactra Matthewsi, *spec. nov.* Plate xi., fig. 4.

Shell ovately trigonal, nearly equilateral, subtruncated behind, obtusely rounded in front. The post-dorsal margin is straight

Digitized by Google

and somewhat sloping, the antero-dorsal one is slightly incurved; the ventral margin is nearly straight, but slightly insinuate posteriorly. The umbo is small and acute.

The shell is thin, concentrically coarsely striated or folded; the colour is yellowish, whitish, or pink, usually varied with brown rays, those at each extremity are broader and more frequently present.

Dimensions.—Antero-posterior diameter, 18; umbo-ventral diameter, 11·5; sectional diameter of united valves, six millimetres.

Locality.—Common on the beach at Royston Head (*Matthews*).

This species must not be confounded with *M. Jacksoniensis*, from which is distinguished by its coarse ornament, less arched ventral margin, its blunt posterior margin, the less defined post-dorsal area and the equilaterality. From *M. pusilla*, A. Adams, it differs by not being acuminate at both ends.

Raeta meridionalis, *spec. nov.* Plate xi., fig. 3.

Shell whitish, very thin, translucent; ovately-suboblong, moderately convex antemedially, posteriorly gaping; umbo subacute, curved forward, situated in the anterior three-sevenths.

Anterior margin regularly rounded, ventral margin strongly arched; dorsal line sloping on both sides, more so in front than behind; posterior side narrowed and depressed, its margin somewhat squarely truncated and slightly reflected. There is an ill-defined depressed post-dorsal area, but no umbonal ridge.

Sinus widely rounded, horizontal, reaching to the centre, visible on the exterior.

Surface marked by fine lines of growth, which become more conspicuous and finely wavy wrinkled on the post-dorsal area,

Dimensions.—Antero-posterior diameter, 35; umbo-ventral diameter, 30; sectional diameter of left valve, eight millimetres.

Locality.—One valve collected by Mr. Magarey on the beach of Aldinga Bay.

Venerupis iridescens, *spec. nov.* Plate xi., fig. 10.

Shell rhomboidal, subdepressed; post-dorsal line straight; anterior side very short and narrow, slightly concave in front of the depressed acute umbo; posterior side long, expanded, squarely truncated at its margin, but rounded off post-ventrally; there is no defined umbonal ridge; ventral margin having a slight outward curve in its posterior half, thence rapidly ascending to the roundly attenuated front; umbo in about the anterior third.

Colour dirty white, iridescent, with a few spots of reddish brown. Ornament of concentric laminæ (about 15 conspicuous ones), and three or four concentric rounded threads in the inter-

Digitized by Google

spaces; the interstitial liræ and the umbonal aspect of the laminæ are crossed by fine, close striæ. The laminæ are erect, short, with an acute, slightly and irregularly broken edge.

Dimensions.—Antero-posterior diameter, 14·5; umbo-ventral diameter, 9·5; sectional diameter of united valves, 6 millimetres.

Locality.—One fresh specimen dredged in deep water off Kangaroo Island, Spencer Gulf (S. Aust. Mus.).

The only species having concentric striate ornament between the lamellæ, and without radial riblets are *V. tumida*, Sow., and *V. interstriata*, Sow.; the former shell is ventricose, and both are very finely striated between the lamellæ, whilst the present species is depressed, and the interstitial ornament consists of round threads, other less striking differences can be pointed ont.

Cardium erugatum, *spec. nov.* Plate xi., fig. 6.

Shell obliquely subquadrate, about as long as high; narrowed and rounded in front, broadish and curvedly truncate behind; inequilateral, moderately convex, pure white, and ornamented with about 25 flat ribs, much broader than the furrows. The medial ribs are wider than the anterior or posterior ones; the anterior ribs bear close, transverse, compressed scales.

Dimensions.—Antero-posterior diameter, 13; umbo-ventral diameter, 12·5; sectional diameter, 7 millimetres.

Locality.—A few single valves cast up at Royston Head, Southern Yorke Peninsula (G. F. Matthews).

This species seems to resemble *C. Dionæum*, Sowerby, but it has not the spinosely dentated ribs of that shell.

Carditella subradiata, *spec. nov.* Plate xi., fig. 7.

Shell minute, ovately trigonal, inequilateral, moderately convex; umbo large, antemedian; anterior side rounded, a little incurved in front of the umbo; ventrally rounded; posterior side a little produced, the post-dorsal slope nearly straight, inclined at an acute angle. Inner margin of valves distantly and deeply crenulated.

Surface smooth, shining, radially faintly ribbed, and concentrically coarsely striated. The ribs are about 15 in number, depressed, wider than the interspaces.

Dimensions.—Antero-posterior diameter, 3·5; umbo-ventral diameter, 3·5 millimetres.

Locality.—Shell sand, Royston Head.

This new species most resembles *C. radiata*, from the Eocene beds of the Adelaide district, but is inequilateral, and has an inflated umbo. It is more triangular than C. *infans* with fewer inornate ribs.

Digitized by Google

Kellia rostellata, *spec. nov.* Plate xi., fig. 14.

Shell minute, rather thin, semi-translucent, broadly heart-shaped, a little longer than high, inequilateral and moderately convex.

The dorsal margin is oblique on both sides, longer behind than in front, and excavated in front of the beaks. The ventral margin is rounded and curves upwards to the narrow and subrostrated anterior margin. The umbos are prominent, rather obtuse at the apex, approximate, not curved in front, and situated well in advance of the middle line.

The surface is finely and closely concentrically striated; the colour is yellowish-horn, umbos and hinge-line brown with a vertical ray of the same colour increasing in breadth from the umbo to the ventral margin.

Dimensions.—Antero-posterior diameter, about 2·5; umbo-ventral diameter, 2; sectional diameter of united valves, 2 millimetres.

Locality.—Dredged in life, seven to nine fathoms, attached to seaweed, Port Phillip Heads, Victoria *(J. B. Wilson)*.

This species has a general resemblance to *Lasæa rubra*; but apart from the difference of dentition, it is distinguished by its subrostrated anterior side.

Montacuta semiradiata, *spec. nov.* Plate xl., fig. 2.

Shell minute, transversely ovate, moderately convex; umbos antemedian, thick and rounded; anterior and posterior margins rounded, ventral margin slightly curved outwards, posterior slope gently descending.

Surface smooth, shining, of a chocolate-brown colour, more or less translucent-white medially, with a few distant angular threads, appearing as pellucid rays, radiating from the umbo to the posterior half of the ventral margin.

Dimensions. — Antero-posterior diameter, 2; umbo-ventral diameter, 1·5.

Locality.—Parasitic on *Echinocardium*, east of Mud Island, Port Phillip, in seven to ten fathoms *(J. B. Wilson)*.

Ephippodonta, *gen. nov.*

Name in allusion to the cardinal teeth riding as it were one on the other by their tips, and not interlocking.

Types.—Scintilla lunata, *Tate*, and Ephippodonta McDougalli, *spec. nov.*

Shell like *Galeomma*, flexible in life but brittle when dry, with two cardinal teeth in each valve, which are more or less bifid at their summits and opposed to each other and not alternating; a large cartilage is wedged in between the teeth, and the dorsal margin is internally thickened.

Digitized by Google

The animal has the mantle lobes free all round to the dorsal line; in life the anterior margins of the lobes are largely expanded in a funnel form. The foot is somewhat disk shaped, very voluminous, and constitutes a broad locomotory surface.

This genus is separable from *Galeomma* and *Scintilla* by possessing two cardinal teeth in each valve, which are in apposition. The free mantle-lobes distinguish it further from *Galeomma;* the animal of *Scintilla* appears to be undescribed.

The animal of both species of *Ephippodonta* has the creeping habit of *Galeomma*, the valves are flexible and spread out flat when the animal is in motion; indeed, while in life the valves cannot be brought to a less angle of divergence than about 70 degrees.

Both species live on the mud-formed burrows of a shrimp, sheltering beneath large stones between tide-marks at Edithburg, Yorke Peninsula, South Australia.

Ephippodonta McDougalli, *spec. nov.* Plate xi., figs. 5*a*—5*b*.

Shell small, with each valve approximately semicircular in outline, subequilateral, flat, yellowish-white, dull.

Umbo inconspicuous. Surface of the valves with numerous compressed slender ridges, radiating from the umbo, about 21 principal ones regularly disposed with one or two smaller ones interposed, all bearing papillary scales; the margin of the valves with about 60 equal and equidistant square and deep crenatures.

Dimensions.—Length of dorsal line, 10; umbo-ventral diameter, 6 millimetres.

Locality.—Edithburg, St. Vincent Gulf *(McDougall).*

This species differs from its congener by its inconspicuous umbo, by its conspicuous radial ribs, the indented free margin of the valves, and more regular outline.

Voluta Adcocki, *spec. nov.* Plate xi., fig. 8.

Shell oval-fusiform, spire moderately elongated terminated by a papillary pullus; whorls with a row of transversely elongate tubercles on the periphery (about 11 to a whorl). Aperture oval-elongate; outer lip thickened internally, but bevelled off to a thin edge, not reflected; columella with four oblique plaits increasing in size from the front backwards.

Colour yellowish-white with undulate, narrow, chestnut, transverse lines—the depth of the plication of the colour lines being intermediate between *V. Angasi*, Tate, and *V. undulata*, Lamarck; on the last whorl are two somewhat narrow chestnut spiral bands, one in front of the row of nodulations and in an alignment with the posterior angle of the aperture, the other about midway to the front on the dorsal aspect.

Digitized by Google

Dimensions.—Of the small example of 5 whorls—total length 41, of aperture 31 ; width of last whorl, 19 millimetres. Of the larger example—total length by estimate, 53 ; of aperture, 40 ; width of last whorl, 25 millimetres.

Locality.—One example, cast up at Middleton *(Mr Adcock)*; the species previously known to Mr. Bednall by an example without locality in the South Australian Museum.

This species has the general aspect of *V. Pacifica*, *V. Kreuslerœ*, and *V. Thatcheri*, and, like them, has peripheral nodulations ; in the arrangement of the colour lines it combines the characteristics of *V. Bednalli*, A. Brazier, and *V. Angasi*, Tate. It is a much wider shell with a shorter spire than either *V. Kreuslerœ* or *V. Thatcheri*, and specially differs from *V. Pacifica* by its narrow aperture, not widening anteriorly as in that species.

Stylifer brunneus, *spec. nov.* Plate xi., fig. 9.

Shell subglobose ; spire short, acuminately produced ; apex cylindrical, styliform ; the other whorls are convex, of moderate increase, slightly depressed at the posterior suture ; sutures linear. Last whorl large, faintly angulated at the base and depressed at the suture, and in consequence having a perceptibly subquadrate outline.

Outer lip thin, regularly curved, acutely angled posteriorly ; columella thin, slightly elevated, defined by a superficial groove behind.

Colour dark brown, shining, black-brown around the suture, marked with microscopic crowded obliquely transverse lines and with distant spiral lines.

Animal with a large expanded disk-like mantle.

Dimensions.—Length, 5 ; breadth, 3·5 millimetres.

Locality.—Parasitic on *Strongylocentrotus*, invariably on the periproct, in eight to ten fathoms, Capel Sound, Port Phillip (*J. B. Wilson*).

This new species resembles in its squat shape *S. Turtoni*, *S. astericola*, *S. ovoideus*, and *S. dubia;* but it has not the insinuated outer lip, obtusely-angled posteriorly, of those species. In its regular curved outer lip and general shape it agrees with *S. Stimpsoni*, Verrill, and *S. Orbignyanus*, Hupe ; but the more rapidly enlarging whorls and subquadrate last whorl distinguish it from them.

Umbrella corticalis, *spec. nov.* Plate xi., fig. 11.

Shell orbicular in outline, moderately elevated, with the apex prominent, somewhat incurved, and a little excentric ; covered, except apex, with a well developed epidermis, which extends about half as far again as the shell. The epidermis is raised into about 20 broad rays, diverging from the apex, and is concentri-

Digitized by Google

cally lamellose. It is pellucid white, but encircled with a band of maroon colour, corresponding with the edge of the shell; it is very tough, and can be readily removed in one piece.

The shell is of a primrose-yellow colour, thin, concentrically striated, and with a few obscure radial ridges.

The animal is of a deep port-wine colour; the foot is circular in outline, with an extended margin; the underside of the mantle is covered with small white carunculæ.

Dimensions.—Transverse diameters, 19 and 15; height, 4 millimetres.

Localities.—Lower end of the South Channel of Port Phillip, seven to sixteen fathoms, sand and weed (*J. B. Wilson*). It has also been collected more than once in St. Vincent Gulf.

Lobiger Wilsoni, *spec. nov.* Plate xi., fig. 12.

Animal with the body produced into a very narrow, pointed, smooth tail of a green colour, shortly extended beyond the shell. Foot with two oblong-rounded and pale-green lobes, which are somewhat attenuated into a broadish stalk.

Shell thin, flexible, straw-yellow; spire rudimentary but involute. Somewhat pyriform, slightly attenuated in front, and truncated apically; aperture narrow-ovate, truncate behind. Surface finely striated. Length, 8; width, 5 millimetres.

Locality.—Lower end of South Channel of Port Phillip, seven to sixteen fathoms *(J. B. Wilson).*

EXPLANATION OF PLATE XI.

1. Cœlodon patulus, *Tate.* Enlarged.
2. Montacuta semiradiata, *Tate.* Much enlarged.
3. Raeta meriodionalis. *Tate.* Natural size.
4. Mactra Matthewsi, *Tate.* Slightly enlarged.
5. Ephippodonta McDougalli, *Tate.* *a*, Shell enlarged; *b*, the valves laid opened to display cardinal teeth and cartilage, much enlarged.
6. Cardiaum erugatum, *Tate.* Slightly enlarged.
7. Carditella subradiata, *Tate.* Much enlarged.
8. Voluta Adcocki, *Tate.* Natural size.
9. Stylifer brunneus, *Tate.* Enlarged.
10. Venerupis iridescens, *Tate.* Slightly enlarged.
11. Umbrella corticalis, *Tate.* Natural size.
12. Lobiger Wilsoni, *Tate.* Enlarged.
13. Teredo fragilis, *Tate.* *a*, Tube, natural size; *b*, a pallet much enlarged; *c*, siphonal orifice of tube, enlarged.
14. Kellia rostellata, *Tate.* Much enlarged.

Digitized by Google

A Supplement to a List of the Lamellibranch and Palliobranch Mollusca of South Australia.

By Professor Ralph Tate, F.L.S., F.G.S.

[Read October 2nd, 1888.]

Such excellent results in conchological pursuits have been gained by some of my friends since the publication of my list of the South Australian bivalves two years ago, that to delay longer making known their discoveries would be undesirable, especially because some of the species are undoubtedly new to science.

The actual additions are 17 in number, and bring up the total to 187. Seven of them I consider to be diagnostically unknown. An uncertain species of Teredo has, through acquisition of complete material, been better defined, and a distinctive cognomen applied to it. The names of two of our fresh-water mussels were inadvertently misapplied. The corrections are herewith made, and a better specific determination is offered for a third, and a new one added.

To the list of species recorded for South Australia, but on insufficient data, should be added *Cardium donaciformis* reported as collected at Port Lincoln by Harvey; it is not improbable that *Donax cardioides* has been mistaken for it.

The sequence of the additional species in the classification, adopted in the original paper, is indicated by the numerals prefixed to the specific names.

Lamellibranchiata.

1. Teredo fragilis, Tate, *antea*, p. 60. Teredo sp. of Port Creek.

10*a*. Panopæa australis, Sowerby, Genera of Shells, No. 40, fig. 2. Ovate oblong, concentrically wrinkled, wider in front, obliquely truncated behind. Rapid Bay *(R. H. Pulleine)*; Hardwicke Bay, Spencer Gulf *(G. F. Matthews)*; also Victoria, Tasmania, New South Wales.

18*a*. Thracia modesta, Angas, Proc. Zool. Soc., 1867, t. 44, fig. 3, p. 908. Small, ovate, posterior side vertically truncate. Tapley Shoal *(Matthews* and *McDougall)*; also New South Wales.

18*b*. Cœlodon patulus, Tate, *antea*, p. 60. Wool Bay, St. Vincent Gulf, in ten fathoms *(Matthews* and *McDougall)*; Spencer Gulf, off Kangaroo Island *(S. Aust. Mus)*.

Digitized by Google

22*a*. MACTRA MATTHEWSI, Tate *antea*, p. 60. Royston Head *(Matthews)*.

28*a*. RAETA MERIDONALIS, Tate, *antea*, p. 61. Aldinga Bay *(T. C. A, Magarey)*.

46*a*. TELLINA MODESTA, Sowerby, Proc. Zool. Soc., 1883, t. 7, fig. 1, p. 31. A delicate white shining ovate shell with the posterior side slightly flexuous. Holdfast Bay *(D. J. Adcock)*; also New South Wales,

56*a*. VENERUPIS IRIDESCENS, Tate, *antea*, p. 61. Spencer Gulf *(S. Aust. Mus.)*.

76*a*. CYTHEREA DISRUPTA, Sowerby, Thes. Conch., p. 117, t. 163, figs. 208, 209. Transversely ovate, somewhat acuminate behind, yellowish, blotched with purple-brown, in a more or less radiating manner. The South Australian examples are of small size—about three quarters of an inch—with surface concentrically sulcated rather than striated. Adult examples from New South Wales attain to two and three-quarter inches long. Spencer Gulf, off Kangaroo Island *(S. Aust. Mus.)*; also New South Wales and Tasmania.

86*a*. CARDIUM ERUGATUM, Tate, *antea*, p. 62. South Yorke Peninsula *(Matthews)*.

98*a*. SACCHIA ADAMSI, Angas, as Mysia *(Felania)*, in Proc. Zool. Soc. 1867, t. 44, fig. 9, p. 910. Orbicular, depressed; hinge plate largely developed, grooved for reception of internal cartilage. Length and width about half an inch. Royston Head *(Matthews)*; also New South Wales.

111*a*. EPHIPPODONTA McDOUGALLI, Tate, *antea*, p. 64. Edithburgh, Yorke's Peninsula *(McDougall)*. *Scintilla lunata* also belongs to this new genus.

114*a*. CARDITA BEDDOMEI, E. A. Smith, in Voy. Challenger, t. 15, f. 5, p. 211. Sub-quadrate with about 30 ribs, bearing numerous small transverse nodules, spotted with orange on the medial and posterior areas; sulci rather narrower than the ribs. Length about five-eighths by half of an inch. Spencer Gulf, off Kangaroo Island *(S. Aust. Mus.)*; also Bass Straits.

114*b*. CARDITA SQUAMIGERA, Deshayes. Mag. Zool. 1853, p. 10. Reeve, Icon. Con., t. 4, f. 14. Broadly cordate, very wide and truncated behind; 20 narrow ribs, bearing sub-erect long scales becoming arched or tubular at the ventral margin. Length, three-eighths of an inch; width, quarter of an inch. Spencer Gulf, off Kangaroo Island *(S. Aust. Mus.)*. Locality unknown *(Reeve)*.

Digitized by Google

119*a*. CARDITELLA SUBRADIATA, Tate, *antea*, p. 62. Royston Head, Yorke Peninsula *(Matthews)*.

121. UNIO ANGASI, Sowerby in Reeve's Icon. Conch., 1868, t. 55, f. 282. *U. Shuttleworthi*, Lea, is an older name, but is preoccupied by another Australian species described by Kuster.

122. UNIO EVANSI. *U. vittatus*, Lea, in Reeve's Icon. Conch., t, 83, seems to represent this species. Lagoons of the River Murray and Lake Alexandrina. Not in New South Wales.

123. UNIO AUSTRALIS, Lamarck. Rivers Para and Onkaparinga.

123*a*. UNIO AMBIGUUS, Philippi. Scott's Creek, River Bremer, River Murray, Lake Alexandrina, and Mosquito Creek. By some authors this is referred to *U. australis*, but it differs by its shorter anterior side, less sloping anterior dorsal margin, and by the less ventricosity, especially in the umbo-post-ventral region.

151*a*. PINNA TASMANICA, Tenison Woods in Proc. Roy. Soc. Tasmania for 1875. Wedge-shaped, ribbed; ribs towards the margin furnished with a few, irregularly placed, much raised tubular scales. Dead valves dredged in 11 to 15 fathoms off Tapley Shoal, St. Vincent Gulf *(Matthews* and *McDougall)*; also Victoria and Tasmania.

CLASS PALLIOBRANCHIATA.

3*a*. MAGASELLA CUMINGI, Davidson 1852; *Reeve*, Conch. Icon., Terebratula, t. 7, f. 30. Smooth, ovate-oblong, ventral valve much deeper, with a produced and incurved beak. Length about one-third of an inch. Living examples dredged in 11 to 15 fathoms off Tapley Shoal *(Matthews* and *McDougall)*; dead shells from 27 fathoms off Encounter Bay; also New South Wales and Tasmania.

Digitized by Google

A Census of the Molluscan Fauna of Australia.

By Professor Ralph Tate, F.L.S., F.G.S.

[Read October 2nd, 1888.]

My object is, in this essay, to present a comprehensive view of the constituents of the molluscan fauna of South Australia (omitting Polyzoa), and to indicate their exoteric relationships.

The accompanying tables are based upon a list of species showing their occurrences by political boundaries, which I have been compiling for the past ten years, partly as the result of bye-work in connection with the distribution of the genera in the Australian Tertiary deposits. This list cannot be without faults, but I think it makes a fair approach to accuracy both as to specific identities and distribution. I fear, however, that the number of species is in excess, as some of our Australian workers have relied too much on geographical isolation as an index to specific distinction; still, the duplication cannot be very serious as to affect the general conclusions at which I have arrived and submitted herein.

It is admitted that terrestrial provinces are not necessarily co-ordinate with marine ones, and it is the more desirable to review them independently, inasmuch as the terrestrial and fluviatile species of Australia are exclusively endemic, if we except a few species of *Melania* and *Neritina*.

The Marine Molluscan Fauna of Australia.

The marine fauna admits of grouping into two sections—one occupying the tropical shores, and largely consisting of migrants from the Oriental Marine Province; and the other belonging to the temperate waters, and largely consisting of endemic species and possessing several restricted genera. Where to draw lines of demarcation between the two regions is a difficulty, as no actual barriers to migration occur; on the east the transition is more pronounced than on the west coast, and I select the latitude of Maryborough, coinciding with the southerly termination of the Great Barrier Reef as a convenient point of separation. On the west coast a tropical fauna prevails as far south as Shark Bay, whilst at Freemantle the Australian species are in an ascendancy; no extensive lists of species have been published from any one locality north of King George's Sound, so that I

Digitized by Google

have no guide for delimitation. However, in my list all West Australian species from north of Swan River have been entered as belonging to the Indo-Australian Province.

The Australian province has yielded 1,672 species, of which 1,274, or 76 per cent., are restricted. Of the 399 extra-limital species, 57 are migrants to or from New Zealand, which is an outlier of the larger Australian province, whilst not a few others extend to the South Polynesian area, which has also received species from the Indo-Australian Province. Thirteen other components of this fauna link temperate Australia and South Africa. The only cosmopolitan species are *Saxicava arctica*, *Teredo nivalis*, *Lasæa rubra*, and *Ostrea edulis* (if *O. Angasi* be not distinct). Thus by these eliminations the actual number of Oriental species is reduced to 300, or about 18 per cent. of the whole.

The Indo-Australian Province has yielded 1,495 species, of which 676, or 45·2 per cent., are endemic in Australia, so that more than half the species are migrants from the Oriental Province.

The percentage of endemic species for the whole of Australia is 64, and for each class as follows:—Cephalopoda, 75·6; Gastropoda, 63·8; Scaphopoda, 28·5; Pteropoda, 0; Conchifera, 65·6; Palliobranchiata, 53.

The following table summarises the distribution of the marine species in each class or large group :—

Digitized by Google

Class.	Australian Province.		Indo-Australian Province.		Common to both Provinces.		Total Species in both Provinces	Total Endemic Species.
	Endemic.	Exotic.	Endemic.	Exotic.	Endemic.	Exotic.		
Cephalopoda	24	5	6	8	...	2	41	30
Gastropoda (Pectinibranchs)	786	237	356	528	50	108	1,749	1,092
" (Opisthobranchs)	89	23	33	33	4	8	166	118
Pulmonata	31	5	13	13	3	1	58	41
Scaphopoda	5	1	9	7	...	1	21	14
Pteropoda	...	13	...	...	...	...	13	...
Conchifera	332	109	256	227	42	50	832	546
Palliobranchiata ...	6	6	3	4	...	2	17	9
Totals	1,273	399	676	820	99	172	2,897	1,860
Totals	1,672		1,496		271		2,897	1,860

Digitized by Google

AUSTRALIAN GENERIC TYPES.

The following genera are peculiar:—

CEPHALOPODA.—*Tritaxeopus* (1 sp.).

GASTROPODA.—*Agnewia* (1 sp.); *Zemira* (1 sp.); *Pelicaria* (1 sp.), modified *Struthiolaria*, essentially New Zealandian; *Mesalia* (1 sp.); *Raulinia* (1 sp.), the only living representative of a Parisian Eocene type; *Ampullarina* (3 sp.); *Angasiella* (1 sp.); *Casella* (1 sp.); *Allportia* (1 sp.).

CONCHIFERA.—*Humphreyia* (3 sp.), *Myochama* (4 sp.), *Anapa* (2 sp.), *Ephippodonta* (2 sp.), *Mysella* (2 sp.), *Trigonia* (5 sp.).

PALLIOBRANCHIATA.—*Atretia* (1 sp.).

The following genera have their metropolis in the Australian Province:—

GASTROPODA.—*Cominella* chiefly confined to the temperate seas of the South Hemisphere; *Voluta*, Australia possesses half the number of known species, whilst the sections *Amoria* (10 sp.), *Volutoconus* (1 sp.), and *Mammilliaria* (1 sp.) are restricted; *Phasianella* is conspicuous by the large size attained by several of its species which are individually of common occurrence. *Thalotia*, *Cantharidus*, *Elenchus*, *Bankivia*, and *Crossea* are more largely represented specifically than in other Provinces.

CONCHIFERA.—*Myodora*, *Zenatia*, *Chamostrea*, *Carditella*, *Solenella*, and *Modiolarca* are chiefly confined to the cooler waters of the Southern Hemisphere, and the same observation is equally applicable to the following genera of Palliobranchiata:—*Kraussina* (2 sp.) and *Magasella* (1 sp.). Of less restricted genera of Conchifera, *Crassatella*, *Limopsis*, and *Anatina* are conspicuous by the number of their constituent species.

The Indo-Australian Fauna presents in its generic assemblage the characteristics of the widely-reaching Oriental Province, but some few typical Australian genera are represented, as the *Volutes*, *Trigonia*, *Myochama*, *Modiolarca*; whilst *Parastrophia* and *Watsonia*, among Gastropods, and *Austriella* and *Myrina*, among Conchifers, are peculiar; also North Australia furnishes the four known species of *Placuna*, two of which are endemic.

THE TERRESTRIAL AND FLUVIATILE MOLLUSCAN FAUNA OF AUSTRALIA.

The terrestrial mollusca are in their species very locally distributed, but the genera are nearly all widely dispersed over warm

Digitized by Google

and temperate regions. Of a total of 461 species, only two are extra-australian.

The tropical characteristics of the land snails of N.E. Queensland are indicated by the presence of the genera *Realia*, *Pupina*, *Callia*, *Cyclophorus*, *Diplommatina*, *Leptopoma*, *Helicina*, *Georissa*, *Tornatellina*, *Stenogyra*, *Stenopus*, *Vaginulus*, and the *geotrochoid Helices*; of these *Pupina*, *Helicina*, *Stenopus*, and the section *Geotrochus* of *Helix* extend in a few representatives into more southern latitudes.

The Australasian types (embracing S. Polynesia and New Zealand), which occur chiefly in our extratropical regions, are *Athoracophorus*, *Paryphanta*, *Rhytida* and *Diplomphalus*, and *Cystopelta*, which is peculiar.

The Fluviatile Mollusca are also with few exceptions endemic and of genera of world-wide distribution; it is only in *Melania* (1 sp.) and *Neritina* (5 sp.) that extra-australian species occur. Their esoteric distribution has not yet been fully worked out, and though some species are widely dispersed over the eastern half of the continent, yet the majority are so far only known to occur each in its own hydrographic area.

The genera *Amnicola* (if correctly identified) and *Gundlachia* are American; *Physopsis* in another species is South African; *Mycetopus* and *Larina* are tropical; whilst *Tatea* is peculiar.

SUMMARY OF THE TERRESTRIAL AND FLUVIATILE MOLLUSCA.

Class.	Extratropic.	Tropic.	Total.	Total Endemic.
Gastropoda ...	... 39	28	62	46
Pulmonata—				
Geophila (operculate) ...	5	37	40	38
Geophila (inoperculate)	261	175	421	421
Limnophila ...	... 69	26	93	93
Conchifera ...	... 26	28	42	41
Totals ...	380	293	658	649

TABLE SHOWING SPECIES IN EACH CLASS.

	Endemic.	Exotic.	Total.
Cephalopoda	30	11	41
Gastropoda	1,256	721	1,977
Pulmonata	593	19	612
Scaphopoda	14	7	21
Pteropoda	—	13	13
Conchifera	588	286	874
Palliobranchiata ...	9	8	17
	2,490	1,065	3,555

Digitized by Google

Census of the Mollusca of Australia.

Table of Genera with Number of Species.

Class Cephalopoda.

Family Argonautidæ—		
Argonauta	...	2
Family Octopidæ—		
Tritaxeopus	...	1
Octopus	...	10
Family Teuthidæ—		
Loligo	...	2
Sepioteuthis	...	5
Family Sepiolini—		
Sepiola	...	1
Family Onychoteuthidæ—		
Onychoteuthis	...	1
Family Sepiadæ—		
Sepia	...	8
Sepioloidea	...	1
Family Cranchiadæ—		
Taonius	...	1
Family Spirulidæ—		
Spirula	...	1
Family Nautilidæ—		
Nautilus	...	3

Class Gastropoda.

Order Pectinibranchiata.

Family Muricidæ—		
Murex	...	32
Typhis	...	5
Trophon	...	9
Purpura	...	10
Cuma	...	2
Ricinula	...	9
Rapana	...	1
Coralliophila	...	4
Agnewia	...	1
Family Tritonidæ—		
Triton	...	27
Distorsio	...	1
Epidromus	...	4
Ranella	...	15
Family Fusidæ—		
Fusus	...	14
Fasciolaria	...	3
Peristernia	...	7
Latirus	...	3
Family Fusidæ—		
Leucozonia	...	1
Melongena	...	3
Hemifusus	...	2
Siphonalia	...	6
Tudicula	...	3
Pisania	...	4
Cantharus	...	8
Cominella	...	9
Zemira	...	1
Phos	...	6
Nassaria	...	4
Cyllene	...	1
Family Nassidæ—		
Truncaria	...	1
Nassa	...	38
Neritula	...	1
Family Volutidæ—		
Melo	...	3
Voluta	...	37
Lyria	...	2
Mitra	...	74
Family Marginellidæ—		
Erato	...	7
Marginella	...	43
Family Olividæ—		
Olivella	...	6
Oliva	...	13
Harpa	...	2
Ancillaria	...	8
Family Collumbellidæ—		
Columbella	...	51
Engina	...	5
Terebra	...	45
Euryta	...	2
Family Conidæ—		
Conus	...	41
Family Pleurotomidæ—		
Pleurotoma	...	13
Drillia	...	24
Bela	...	2
Clavatula	...	1
Surcula	...	6
Mangilia	...	38
Clathurella	...	28

Digitized by Google

Family Pleurotomidæ—		
Daphnella	...	13
Raphitoma	...	5
Family Cancellaridæ—		
Cancellaria	...	12
Trichotropis	...	2
Family Strombidæ—		
Strombus	...	17
Terebellum	...	1
Pteroceras	...	3
Pelicaria	...	1
Family Cypræidæ—		
Cypræa	...	59
Trivia	...	9
Ovula	...	8
Neosimmia	...	1
Volva	...	3
Family Doliidæ—		
Dolium	...	4
Pyrula	...	2
Family Cassidæ—		
Cassis	...	4
Semicassis	...	11
Oniscia	...	2
Family Naticidæ—		
Natica	...	15
Neverita	...	28
Amaura	...	2
Sigaretus	...	3
Naticina	...	4
Narica	...	5
Family Marseniadæ—		
Marsenia	...	2
Family Calyptræidæ—		
Calyptræa	...	1
Sigapatella	...	1
Crepidula	...	4
Capulus	...	1
Amathina	...	1
Hipponyx	...	4
Mitularia	...	1
Family Xenophoridæ—		
Xenophora	...	3
Family Vermitidæ—		
Vermetus	...	3
Bivonia	...	2
Thylacodes	...	7
Siliquaria	...	5
Family Turritellidæ—		
Turritella	...	17
Torcula	...	4
Mesalia	...	1
Family Scalariidæ—		
Scalaria	...	25
Cirsotrema	...	5
Crossea	...	5
Family Solariidæ—		
Solarium	...	10
Philippia	...	2
Family Pyramidellidæ—		
Pyramidella	...	20
Odostomia	...	20
Actæopyramis	...	3
Turbonilla	...	17
Eulimella	...	8
Mathilda	...	5
Aclis	...	4
Eulima	...	28
Mucronalia	...	2
Stylifer	...	8
Family Cerithiopsidæ—		
Cerithiopsis	...	7
Family Cerithiacea—		
Cerithium	...	27
Vertagus	...	13
Potamides	...	
Lampania	...	4
Tympanotonos	...	2
Terebralia	...	2
Telescopium	...	1
Pyrazus	...	1
Bittium	...	15
Cerithidea	...	4
Triforis	...	14
Diala	...	13
Styliferina	...	3
Planaxis	...	3
Quoyia	...	1
Litiopa	...	1
Family Littorinidæ—		
Littorina	...	8
Tectaria	...	7
Risella	...	3
Modulus	...	1
Raulinia	...	1
Fossarus	...	3
Fossarina	...	4
Family Heterophrosynidæ—		
Barleeia	...	1
Family Rissoidæ—		
Rissoa	...	39
Rissoina	...	35
Scaliola	...	3
Hydrobia	...	6
Amnicola	...	5

Digitized by Google

Family Rissoidæ—		
Bithynella	...	2
Paludinella	...	1
Tatea	...	1
Bithynia	...	9
Assiminea	...	3
Family Paludiniidæ—		
Paludina	...	9
Larina	...	1
Family Valvatidæ—		
Valvata	...	1
Family Melaniidæ—		
Melania	...	17
Family Cæciidæ—		
Parastrophia	...	1
Watsonia	...	1
Cœcum	...	7
ORDER SCUTIBRANCHIATA.		
Family Neritidæ—		
Nerita	...	10
Navicella	...	1
Neritina	...	9
Family Liotiidæ—		
Liotia	...	16
Adeorbis	...	3
Cyclostrema	...	15
Cirsonella	...	1
Delphinula	...	2
Family Rotelliidæ—		
Ethalia	...	3
Family Turbinidæ—		
Phasianella	...	7
Turbo	...	20
Collonia	...	1
Calcar	...	5
Family Trochiidæ—		
Trochus	...	11
Zizyphinus	...	20
Turcica	...	1
Thalotia	...	12
Cantharidus	...	11
Elenchus	...	11
Gibbula	...	15
Solariella	...	9
Monodonta	...	2
Polydonta	...	4
Clanculus	...	21
Monilea	...	4
Euchelus	...	6
Trochocochlea	...	4
Bankivia	...	1
Leiopyrga	...	2
Family Trochiidæ—		
Astele	...	1
Diloma	...	2
Family Haliotiidæ—		
Stomatella	...	8
Stomatia	...	2
Gena	...	4
Haliotis	...	22
Tæinotis	...	3
Family Pleurotomariidæ—		
Schismope	...	5
Scissurella	...	1
Basilissa	...	1
Minos	...	1
Family Fissurellidæ—		
Fissurella	...	12
Macrochisma	...	3
Fissurellidæa	...	3
Emarginula	...	11
Tugalia	...	4
Scutus	...	2
Puncturella	...	2
Rimula	...	1
Zeidora	...	1
Family Patellidæ—		
Patella	...	18
Nacella	...	1
Family Acmæidæ—		
Acmæa	...	10
Scutellina	...	2
Family Ianthinidæ—		
Ianthina	...	3
Recluzia	...	1
ORDER POLYPLACOPHORA.		
Microplax	...	1
Angasia	...	1
Callochiton	...	1
Ischnochiton	...	8
Callistochiton	...	2
Chaetopleura	...	2
Tonicia	...	3
Chiton	...	13
Acanthopleura	...	4
Stenochiton	...	1
Lorica	...	3
Schizochiton	...	1
Plaxiphora	...	4
Acanthochiton	...	4
Notoplax	...	1
Onithochiton	...	2
Cryptoplax	...	6

Digitized by Google

ORDER TECTIBRANCHIATA.

Family Tornatellidæ—		
Actæon	...	3
Buccinulus	...	10
Ringicula	...	9
Family Bullidæ—		
Bulla	...	8
Haminea	...	8
Atys	...	14
Akera	...	3
Cylichna	...	13
Volvula	...	2
Diaphana	...	2
Tornatina	...	13
Utriculus	...	2
Myonia	...	2
Scaphander	...	1
Aplustrum	...	1
Hydatina	...	3
Family Lophocercidæ—		
Lophocercus	...	1
Lobiger	...	1
Cylindrobulla	...	1
Family Philinidæ—		
Philine	...	2
Chelidonura	...	1
Family Aplysiidæ—		
Aplysia	...	9
Dolabrifera	...	1
Dolabella	...	2
Family Pleurobranchiadæ—		
Pleurobranchus	...	1
Pleurobranchidium		1
Umbrella	...	2

ORDER NUDIBRANCHIATA.

Family Doridida—		
Doris	...	13
Angasiella	...	1
Casella	...	1
Chromodoris	...	6
Gonidoris	...	1
Polycera	...	1
Plocamophorus	...	2
Triopia	...	1
Ceratosoma	...	2
Family Doridopsidæ—		
Doridopsis	...	5
Family Tritoniadæ—		
Bornella	...	1
Melibæa	...	1
Family Æolidæ—		
Æolis	...	2
Flabellina	...	3
Janus	...	1
Glaucus	...	1
Family Elysiidæ—		
Elysia	...	2
Allportia	...	1
Family Phyllirhoidæ—		
Phyllirhoe	...	1

CLASS SCAPHOPODA.

Dentalium	...	11
Entalis	...	5
Siphodentalium	...	2
Cadulus	...	3

CLASS PTEROPODA.

Hyalea	...	8
Styliola	...	1
Cuvieria	...	1
Cymbula	...	1
Tiedemannia	...	1
Spiralis	...	1

CLASS PULMONATA.

Family Auriculidæ—		
Auricula	...	3
Alexia	...	1
Pythia	...	1
Marinula	...	1
Melampus	...	12
Cassidula	...	6
Plecotrema	...	6
Family Amphibolidæ—		
Ampullarina	...	3
Family Siphonariidæ—		
Siphonaria	...	10
Gadinia	...	2
Family Onchidiidæ—		
Onchidium	...	4
Family Truncatellidæ—		
Truncatella	...	7
Blandfordia	...	2
Family Cyclostomidæ—		
Realia	...	1
Pupina	...	17
Callia	...	1
Diplommatina	...	3
Cyclophorus	...	4
Leptopoma	...	1
Helicina	...	12
Georissa	...	1

Digitized by Google

Family Arionidæ—		
Cystopelta	...	1
Family Limacidæ—		
Limax	...	2
Amalia	...	2
Family Vitrinidæ—		
Helicarion	...	18
Parmacochlea	...	1
Family Helicoidea—		
Rhytida	...	19
Diplomphalus	...	4
Paryphanta	...	4
Family Zonitidæ—		
Nanina	...	14
Zonites	...	36
Stenopus	...	3
Family Succineidæ—		
Succinea	...	11
Athoracophorus	...	1
Family Vaginulidæ—		
Vaginulus	...	1
Family Helicidæ—		
Cœliaxis	...	1
Vertigo	...	10
Tornatellina	...	6
Stenogyra	...	1
Bulimus	...	24
Helix	...	261
Family Limnædæ--		
Limnæa	...	13
Amphipeplea	...	1
Bulinus	...	60
Physopsis	...	1
Ancylus	...	4
Gundlachia	...	1
Planorbis	...	11
Segmentina	...	2

CLASS LAMELLIBRANCHIATA.

Family Gastrochænidæ—		
Aspergillum	...	3
Humphreyia	...	3
Clavagella	...	2
Gastrochæna	...	3
Family Teredinidæ—		
Teredo	...	4
Family Pholadidæ—		
Barnea	...	2
Jouannetia	...	1
Parapholas	...	2
Martesia	...	1
Family Solenidæ—		
Solen	...	7
Family Solenidæ—		
Cultellus	...	1
Solecurtus	...	4
Family Saxicavidæ—		
Saxicava	...	1
Panopæa	...	1
Family Myacidæ—		
Mya	...	1
Corbula	...	10
Cryptomya	...	1
Poromya	...	2
Neæra	...	7
Family Anatinidæ--		
Cœlodon	...	2
Myodora	...	10
Myochama	...	4
Thracia	...	9
Lyonsia	...	1
Anatina	...	16
Family Mactridæ—		
Mactra	...	29
Rangia	...	1
Lutraria	...	4
Zenatia	...	1
Ræta	...	1
Eastonia	...	1
Moldia	...	1
Family Paphidæ—		
Paphia	...	13
Anapa	...	2
Ervilia	...	1
Family Semelidæ—		
Semele	...	13
Syndosmya	...	2
Cumingia	...	1
Family Tellinidæ—		
Asaphis	...	1
Psammobia	...	14
Sanguinolaria	...	1
Hiatula	...	7
Tellina	...	49
Metis	...	1
Macoma	...	13
Arcopagia	...	7
Phyllodia	...	1
Gastrana	...	1
Donax	...	13
Family Petricolidæ—		
Petricola	...	1
Naranio	...	2
Venerupis	...	14
Saxidomus	...	1

Digitized by Google

Family Veneridæ—		
Venus	...	8
Chione	...	29
Cytherea	...	19
Circe	...	15
Meroe	...	6
Dosinia	...	22
Clementina	...	2
Tapes	...	18
Family Glaucomyidæ—		
Glaucomya	...	2
Family Cycladidæ—		
Sphærium	...	6
Pisidium	...	4
Corbicula	...	11
Cyrena	...	11
Family Isocardiidæ—		
Cypricardia	...	1
Trapesium	...	1
Coralliophaga	...	1
Family Cardiidæ—		
Cardium	...	21
Family Verticordiidæ—		
Verticordia	...	2
Family Chamidæ—		
Chama	...	12
Chamostrea	...	1
Family Tridacnidæ—		
Hippopus	...	1
Tridacna	...	4
Family Lucinidæ—		
Lucina	...	22
Loripes	...	4
Austriella	...	1
Cryptodon	...	2
Corbis	...	2
Family Ungulinidæ—		
Diplodonta	...	10
Sacchia	...	2
Family Erycinidæ—		
Montacuta	...	4
Lasæa	...	1
Lepton	...	4
Pythina	...	3
Galeomma	...	2
Scintilla	...	9
Ephippodonta	...	2
Mysella	...	2
Kellia	...	8
Family Solemyidæ—		
Solemya	...	1
Family Astartidæ—		
Crassatella	...	15
Family Astartidæ—		
Cardita	...	16
Carditella	...	4
Mytilicardia	...	11
Thecalia	...	1
Family Unionidæ—		
Mycetopus	...	1
Unio	...	20
Family Trigoniidæ—		
Trigonia	...	5
Family Nuculidæ—		
Nucula	...	11
Leda	...	15
Solenella	...	1
Family Arcidæ—		
Arca	...	5
Barbatia	...	17
Scapharca	...	2
Trisis	...	2
Pectunculus	...	12
Limopsis	...	8
Family Mytilidæ—		
Mytilus	...	12
Modiola	...	10
Lithodomus	...	9
Modiolaria	...	7
Myrina	...	1
Septifer	...	1
Modiolarca	...	2
Family Aviculidæ—		
Avicula	...	5
Meleagrina	...	4
Perna	...	4
Crenatula	...	4
Vulsella	...	3
Malleus	...	4
Family Pinnidæ—		
Pinna	...	13
Family Spondylidæ—		
Spondylus	...	11
Plicatula	...	3
Family Limidæ—		
Lima	...	7
Limea	...	1
Family Pectinidæ—		
Pecten	...	33
Amusium	...	5
Family Anomiidæ—		
Anomia	...	1
Placunanomia	...	2
Family Placuniidæ—		
Placuna	...	4

Digitized by Google

Family Ostreidæ—		
Ostrea	...	11
CLASS PALLIOBRANCHIATA.		
Family Terebratulidæ—		
Terebratula	...	1
Waldheimia	...	1
Terebratulina	...	1
Magasella	...	1
Megerlia	...	2
Family Terebratulidæ—		
Kraussina	...	2
Family Rhynchonellidæ—		
Atretia	...	1
Family Craniidæ—		
Crania	...	1
Family Discinidæ—		
Orbicula	...	1
Family Lingulidæ—		
Lingula	...	6

Digitized by Google

Additions to the Flora of the Port Lincoln District, including brief Descriptions of Two New Species.

By Professor Ralph Tate, F.L.S., F.G.S.

[Read October 2, 1888.]

A hurried excursion, occupying a few days in the early part of November, 1887, in the Port Lincoln district, brought to my knowledge the occurrence of 51 species not hitherto known there. The country traversed is well within the wettest part, and is therefore the most typical portion of the phytographic district of Southern Eyre Peninsula. The route was from Port Lincoln by way of Little Swamp, the Fountain, to Lake Wangary, to Marble Range, to Kellidie Bay (an extension of Coffin Bay), to Strawberry and Winter's Hills on the west slope of the coast range, which extends north from Port Lincoln, and back to the seaport. The leading physical features are—

1. The coast range, consisting of metamorphic rocks, is clothed with open forests of Casuarina, and Eucalypts according to the nature of the soil.

2. A low depressed area, to the west, extends to the coast line on the south-west, and is interrupted on the north-west by isolated peaks of metamorphic rocks, as Marble Range (a misnomer, as the rock is a hard highly metamorphic quartzite), North Block, &c. Towards the sea-coast much of this depressed country is occupied by swamps, whilst the relatively high ground, or rises, constitutes heath lands, or grass lands interspersed with thickets and light timber, particularly of *Eucalyptus corynocalyx*.

Ranunculus aquatilis. Swamps at Little Swamp and near Kellidie Bay.

Ranunculus lappaceus. Thickets near Fountain.

Drosera pygmæa. Wet heath near Little Swamp.

Comesperma calymega. Wet heath near Little Swamp.

Commerçonia Tatei, *F. v. Mueller*. Heath ground near Fountain. This new species is a low diffuse under-shrub, with the branches extending to one foot or more, with "remarkably reduced cyme, only one or two flowers as a rule being developed."

Thomasia petalocalyx. Heath ground, Fountain.

Claytonia calyptrata. Marble Range.

Rumex Brownii, Bushy places near Fountain; Marble Range.

Digitized by Google

Haloragis tetragyna. Heathy ground, rather general.
Myriophyllum verrucosum. Swamps, common.
Myriophyllum Muelleri. Swamps, common.
Grevillea lavandulacea. Marble Range.
Hydrocotyle hirta. Coomonoga, near Little Swamp.
Lagenophora Billardieri. Kellidie Bay; Winter's Hill; Marble Range.
Brachycome Muelleri. Bushy places near Fountain.
Brachycome cuneifolia, *Tate*. Bushy places near Fountain. A tufted glabrous annual; leaves radical, thin, narrow-cuneate or spathulate, coarsely and deeply obtusely toothed, attenuated into a narrow petiole, mostly one to one and a half inches. Scapes several, one flowered, about three inches long, with a linear-lanceolate bract towards the base. Heads about one quarter inch in diameter; ray-flowers conspicuous, blue, very narrow, in a single row; scarious margin of involucral bracts, blue; achenes flat, with an entire membranous wing; pappus minute. In the habit this new species recalls *B. decipiens*, from which it is readily distinguished by its winged fruits.
Cotula filifolia. Freshwater swamps, Little Swamp, Fountain, &c.
Cotula cornopifolia. Freshwater swamps, Little Swamp, Fountain, &c.
Cotula australis. Bushy places, Coomonoga, &c.
Leptorrhynchos squamatus. Marble Range.
Stuartina Muelleri. Wet heath ground, Coomonoga.
Erechthites hispidula. Swamp at Fountain.
Podotheca angustifolia. Sandy ground, Lake Wangary to Coffin Bay.
Limnanthemum exaltatum. Swamps at Coomonoga
Limosella aquatica. Lake Wangary.
Wilsonia rotundifolia. Kellidie Bay.
Dichondra repens. Marble Range.
Cynoglossum australe. Kellidie Bay.
Dichopogon laxum. Winter's Hill; Fountain.
Triglochin striata. Fountain; Lake Wangary.
Potamogeton natans. Swamps about Little Swamp, and between Fountain and Kellidie Bay.
Potamogeton pectinatus. Swamps about Little Swamp, and between Fountain and Kellidie Bay.
Lepilæna Preissi. Swamps about Little Swamp, and between Fountain and Kellidie Bay.
Typha angustifolia. Pools on the River Todd.
Xanthorrhœa semiplana. Very widely diffused.
Xanthorrhœa Tateana. Marble Range.

Digitized by Google

Juncus bufonius. Little Swamp.
Juncus pallidus. Marble Range, and towards Kellidie Bay.
Cladium schœnoides. Wet heath, Coomonoga.
Cladium filum. In all the swamps, especially near the sea.
Heleocharis acuta. Little Swamp.
Isolepis cartilagineus. Swamp at Fountain.
Schœnus apogon. Swamp at Fountain.
Stipa semibarbata. Winter's Hill, and other grassy places on the Coast Range.
Stipa aristiglumis. Winter's Hill, and other grassy places on the Coast Range.
Stipa teretifolia. Rocks by the sea, Kellidie Bay.
Agrostis Solandri. Heath ground at Fountain.
Danthonia penicillata. Winter's Hill.
Festuca littoralis. Kellidie Bay, and towards Lake Wangary.
Lepturus incurvatus. Swampy ground at Coomonoga.
Asplenium flabellifolium. Marble Range.

The following additions have been determined from gatherings made by Mrs. Richards at Fowler Bay:—Ranunculus parviflorus, Epaltes Tatei, Gnaphalium indutum, Pterostylis mutica; and at Denial Bay, Orobanche Australiana.

Digitized by Google

Plants of the Lake Eyre Basin.

By Professor Ralph Tate, F.L.S., F.G.S., &c.

In my address delivered before the Biological Section of the Australasian Association for the Advancement of Science at its meeting in August, I occupied myself with the large question of the influence of climatological and geological changes on the distribution of the constituents of the Australian Flora. In it I gave summaries of facts rather than details, and among others those relating to the plants of the Lake Eyre Basin. This flora will have some special interest for us, and I venture to submit to you those particulars of it which are wanting in my address.

The flora of the Lake Eyre Basin was selected as best illustrating the characteristics of the botanical region which I had named Eremian; geographically it is only a small section of the region. Lake Eyre is situated nearly in the centre of the continent, and at or a little below sea level. It occupies the centre of the area of normally high barometric pressure, and minimum rainfall in Australia. The annual rainfall on the south and west does not exceed five inches, though it is a little more on the east; but the whole area is subjected to protracted droughts. The area has passed through extreme climatic vicissitudes, and it offers the very best initial study on the nature and origin of the Eremian flora as a whole.

The basin is vast, but I restrict myself in this communication to the depressed area around the lake—an area that probably coincides with the former extension of the lacustrine waters (now salt to saturation). The bounding more elevated lands on the south, and the Peake ranges on its north-west, and hence to the MacDonnell Range yield, as far as botanically known, the same type of flora, though richer in genera and to some extent specifically distinct. The floral type, which prevails, extends all over the central region of the continent, from the west of the Cordilleras of Eastern Australia to the western seaboard between the Gascoyne and De Grey rivers.

Phytographically, this region isolates the *Autochthonian* (S.W. Australia) from the *Euronotian* (S.E. Australia), the dry intervening country presenting an effectual barrier to an interchange of species. If, as I suppose, that the Lake Eyre basin, which is now a sandy-saline waste, was once occupied by a vast inland sea of fresh water, of which Lakes Blanche and Frome are outliers, whilst contemporaneously Lake Torrens and the system of

Digitized by Google

lakes about Lake Gardner were conjoined, such extension of the inland waters must have largely operated in checking migration from west to east or *vicé versâ*. The only way of intercourse then would have been in more northern latitudes which are beyond the latitudinal distribution of the related species in the two extreme regions. It seems probable that the isolation of the *Autochthonian* flora antedates the period of deposition of the Cretaceous rocks, which occupy so vast an area in Central Australia, and that the Eremian flora was introduced in comparatively recent times.

In the volumes of the Flora Australiensis are recorded many species from the Lake Eyre basin, chiefly based on the collections made by Babbage, Burke and Wills expedition, the Victorian expedition (in search of Burke and Wills), and by Lewis. In most cases topographic definition has not been given, and wherever possible they have been replaced by me in the accompanying list by exact localities.

The collections of plants upon which the bulk of the species is based I owe to the following gentlemen :—

To Mr. J. C. Chandler a small collection gathered in the neighbourhood of Peake and received in 1882.

To Mr. James McLeod for a large collection made at Innaminka, the site of Burke's grave, eleven miles west of the Queensland boundary, received August, 1884; a second collection by the same made in the autumn of the following year along the stock road from Innaminka by the Strzelecki to Lake Frome.

To Mr. Malcolm Murray for a choice collection gathered by him early in 1885 on the south and west sides of Lake Eyre, between Callana and Anna Creek.

To Mr. E. G. Millard for many species collected by him in the spring of 1886 at Kalamurina Station, on the Warburton River (or Lower Diamantina), 30 miles south-east of Cowarie.

I have also examined a collection made by Dr. Cleland in 1886 on a journey from Hergott to Strangways; and also one collected at Tingatingana Station, on the Strzelecki Creek, about midway between Innaminka and Lake Frome.

Lastly, I visited the country about Callana during the winter of the present year.

The sign [!] which is affixed to localities indicates that I have examined authentic specimens, and that the specific determinations are mine.

The list contains the names of 388 species, less than half of the known species in the extratropical part of the South Australian portion of the Eremian region; but it is almost certain that some common plants are not included, and a very slight extension of the assumed southern boundary would largely add to

Digitized by Google

it. The sequence of the orders and the specific names are according to Baron Mueller's Census of the Australian Flora.

In the margin I have indicated the distribution of the extra-australasian species, the abbreviations employed being as follows:—o, Oriental; e, Ethiopian; t, Tropics; a, Andean; med, Mediterranean; cos, Cosmopolitan, or nearly so. The species of exotic origin number 68, which is equivalent to 17 per cent. of the whole; whilst for the whole continent the percentage is twelve, the figures being as follows:—

Immigrant species	1,058	1,236
Emigrant species	178	
Total species	8,800	

The asterisk prefixed to the species-name indicates that the species is essentially Eremian, and the double asterisk that it is peculiarly Eremian.

List of localities:—

South side of Lake Eyre.—Farina, Hergott, Callana, Stuart's Creek, Priscilla Springs; all on the Great Northern Line of Railway.

West side.—Beresford, Strangways and William Springs (tableland adjoining), Anna Creek, and Peake; all on the Great Northern Line of Railway. The Margaret approaches the Railway in the vicinity of Coward Springs.

Cootanoorrinna is about 30 miles south-west from Peake, and Nilpinna is about half-way. The Neales intersects the Telegraph Line 13 miles north of Peake.

North-east side.—Warburton River.

East side.—Innaminka, on Cooper Creek, near here the floodwaters of Cooper Creek discharge into the Strzelecki.

South-east side.—Hamilton Creek, John Creek, Paralana, and Wooltana, on the north-west side of Lake Frome.

List of Species, with Localities, &c.

order cruciferæ.

* Sisymbrium trisectum. Cooper Creek *(Fl. Aust.)*; Strangways!

cardaminoides. Strzelecki Creek!; Warburton River!; Innaminka!

* Erysimum lasiocarpum. John Creek!; Strzelecki Creek!; Warburton River!

* brevipes. John Creek; Lake Frome!; Strzelecki Creek!

Digitized by Google

** Erysimum Blennodia. Innaminka!; Warburton River!; Strzelecki Creek!
** Stenopetalum velutinum. Between Stoke's Range and Cooper Creek *(Fl. Aust.)*.
** nutans. The same.
** croceum. Innaminka!
** Lepidium phlebopetalum. Strangways to Hergott!; Peake!
* monoplocoides. Warburton River!
* papillosum. Between Stokes' Range and Cooper Creek *(Fl. Aust.)*.

ORDER CAPPARIDEÆ.

** Capparis Mitchelli. Cooper Creek *(F. v. M.)*.

ORDER PITTOSPOREÆ.

Pittosporum phillyroides. South of Callana!

ORDER DROSERACEÆ.

Drosera Menziesi. John Creek, Lake Frome!

ORDER MALVACEÆ.

Lavatera plebeia. Strzelecki Creek; Hergott to Strangways!
T. Malvastrum spicatum. Strzelecki Creek!; Hergott to Strangways!; Cootanoorrinna!
Sida corrugata. Warburton River! Innaminka!
** virgata. Hergott to Strangways!
* petrophila. Between Stokes' Range and Cooper Creek *(Fl. Aust.)*. John Creek!
** intricata. Peake!
* calychymenia. The Margaret *(Fl. Aust.)*.
** inclusa. Near Lake Eyre *(Fl. Aust.)*.
** Abutilon halophilum. Innaminka!; Peake!
** diplotrichum. Between Lake Eyre and River Finke *(C. Giles)*.
** leucopetalum. Cooper Creek *(Howitt)*.
** otocarpum. Lake Eyre *(F. v. M.)*.
oxycarpum. Near Lake Eyre *(E. Giles)*.
** Fraseri. Warburton River!; Peake!
O.E. Avicennæ. Cooper Creek *(Wright)*.
O.E. Hibiscus trinum. Cooper Creek.
* Krichauffianus. Cooper Creek *(Victorian Exp.)*.
Sturtii. Wooltana, Lake Frome!
** Gossypium Sturtii. Wooltana!; north-east side of Lake Eyre *(Sturt)*.
* Plagianthus glomeratus. Near Lake Eyre *(C. Giles)*.

Digitized by Google

ORDDR EUPHORBIACEÆ.

* Euphorbia Drummondi. Warburton River!; Innaminka!; Strzelecki Creek.
** erythrantha. Peake!
** Wheeleri. Between Stoke's Range and Cooper Creek *(Wheeler)*; Innaminka!
* eremophila. Between Hergott and Strangsways!; Innaminka!
** Phyllanthus Fuernrohrii. Between Lake Eyre and River Finke *(E. Giles)*.
** lacunarius. The Hamilton! Lake Frome; Warburton River!

ORDER UTICACEÆ.

T.A. Parietaria debilis. Paralana, Lake Frome!

ORDER SAPINDACEÆ.

T. Dodonæa viscosa. Strzelecki Creek!
** microzyga. Neale's River *(Stuart Exp.)*; Strzelecki Creek!
Heterodendron oleifolium. Cooper Creek *(Fl. Austral.)*.
Atalaya hemiglauca. Strzelecki Creek!

ORDER HYPERICINEÆ.

O. Hypericum Japonicum. Strzelecki Creek!

ORDER ELATINEÆ.

O.E. Bergia ammannioides. Innaminka!

ORDER GERANIACEÆ.

Erodium cygnorum. Innaminka!; Peake!

ORDER ZYGOPHYLLEÆ.

O. Tribulus terrestris. Peake!; between Hergott and Strangways!
** hystrix. Between Hergott and Strangways!; Innaminka!
Zygophyllum glaucescens. Strzelecki Creek!
** iodocarpum. Cootanoorrinna, and generally diffused on west side of Lake Eyre!
Billardieri. Innaminka!; between Hergott and Strangways!
fruticulosum. Innamika!
ammophilum. Warburton River!; Innaminka!
** Howitti. Warburton River!
MED. Nitraria Schoeberi. Warburton River!

Digitized by Google

ORDER FRANKENIACEÆ.

MED. Frankenia laevis. Very general!

ORDER CARYOPHYLLEÆ.

Polycarpæa synandra. Sandy flats of Anna Creek!; Wirrawirraloo *(Babbage)*.

O. E Indica. Strzelecki Creek!

ORDER PORTULACEÆ.

Portulaca oleracea var grandiflora. Sandhills at Nilpinna! (*vulgo* 'muneroo').

** Claytonia Balonnensis. Innaminka!; Strzelecki Creek!; Warburton River!; Peake!

** pleiopetala. Wills Creek *(Howitt)*.

** ptychosperma. Between Lake Eyre and River Finke *(F. & M.)*

ORDER AMARANTACEÆ.

** Euxolus Mitchelli. Beresford Springs!; Warburton River!; Strzelecki Creek!; Innaminka!

Ptilotus alopecuroides. Innaminka!

** exaltatus. Lake Frome!; Peake!

** Murrayi. Wills Creek *(Howitt)*

** parvifolius. Stuart Creek *(Babbage)!*; Farina!

** latifolius. Warburton River!; Strzelecki Creek!; Wills Creek *(Howitt)*

** incanus. Warburton River!

O. E Alternanthera triandra. Strzelecki Creek!; the Hamilton!; Lake Frome!; Warburton River!

** Polycnemon Mesembrianthemum. Lake Eyre *(E. Giles)*

ORDER CHENOPODIACEÆ.

Rhagodia crassifolia. Lake Eyre *(Lewis)*.

nutans. Lake Eyre *(E. Giles)*; Innaminka!

* spinescens. Between Hergott and Strangways!

** Chenopodium auricomum. Cootanoorrinna!

* cristatum. Warburton River!; Beresford Springs!

** Atriplex nummularium. Between Hergott and Straugways!

** rhagodioides. Strangways!

* vesicarium. General on west side!

** velutinellum. Stuart Creek *(Babbage)*.

** halimoides. Lake Eyre *(Lewis)*; towards Cooper Creek *(Howitt)*.

** holocarpum. General on west side!

angulatum. Strangways Springs!

Digitized by Google

** Atriplex fissivalve. Cootanoorrinna! A more or less succulent herb, the branches and foliage covered with watery shining papillæ, as in *A. crystallinum*. Perianth with a foliar toothed appendage on each valve, similar to the valve.
** leptocarpum. Warburton River!
Dysphania littoralis. South of Wills Creek *(Howitt)*.
** simulans. Cootanoorrinna!
Enchylæna tomentosa. Strzelecki Creek!
** Bassia bicornis. Cooper Creek *(Dr. Murray)*.
** lanicuspis. Cootanoorrinna!
** bicuspis. Between Stokes Range and Cooper Creek *(Wheeler)*.
diacantha. Warburton River!
** uniflora. Cootanoorrinna and Nilpinna!
** quinquecuspis. Warburton River!
** Babbagia dipterocarpa. Stuart and Elizabeth Creeks *(Babbage)*; Paralana, Lake Frome!; gypsum flats, west side of Lake Eyre!
** acroptera. Warburton River!
** Kochia lanosa. Warburton River!; between Hergott and Strangways!
** eriantha. Between Stokes Range and Cooper Creek *(Wheeler)*.
aphylla. Between Hergott and Strangways!
** sedifolia. Strzelecki Creek!; Paralana!
villosa. Peake!
** ciliata. The Margaret *(Babbage)*; Strzelecki Creek!
appressa. The Margaret *(Babbage)*.
** brachyptera. Cootanoorrinna!
cos. Salsola kali. Between Stokes Range and Cooper Creek *(Howitt)*.
Salicornia australis. Salt flats, very generally distributed!
arbuscula. Salt flats, very generally distributed!
** leiostachya. Lake Eyre *(Lewis)*; Lower Barcoo River *(Howitt)*.

ORDER FICOIDEÆ.

E. Asia, Andean. Tetragonia expansa. Innaminka!; Warburton River!
** Aizoon quadrifidum. Strzelecki Creek! Warburton River!
** zygophylloides. Mount Margaret *(Babbage)*.
** Gunnia septifraga. Stuart Creek (*Babbage*).
o.e. Zaleya decandra. Between Cooper and Wills Creek (*Dr. Murray*).
o.e. Trianthema crystallina. Cootanoorrinna!
** Mollugo orygioides. Cooper Caeek (*Wright*).
Glinus. Strzelecki Creek and Innaminka!

Digitized by Google

ORDER POLYGONACEÆ.

** Rumex crystallinus. Beresford Springs !; Strzelecki Creek !; Innaminka !
·O. Polygonum plebejum. Innaminka !; Strzelecki Creek !
attenuatum. Innaminka !
Muhlenbeckia Cunninghami. Innaminka !; Hergott to Strangways !; William Springs !, &c.

ORDER NYCTAGINEÆ.

·O.E. Bœrhaavia diffusa. Peake !
·O. repanda. Paralana !; Lake Eyre (*E. Giles*).

ORDER LEGUMINOSÆ.

** Isotropis Wheeleri. Between Stokes Range and Cooper Creek (*Wheeler*).
Crotalaria Cunninghami. Between Hergott and Strangways !; Priscilla sandhills !; Strzelecki Creek !
** dissitiflora, var. eremæa. Very general !
* Mitchelli. Wills Creek (*Howitt*); Strzelecki Creek !
** Trigonella suavissima. Warburton River !; Strzelecki Creek !; Beresford Springs !
Lotus australis, var. Peake !; Innaminka !; Table land north of Callana !
Psoralea patens. Between Hergott and Strangways ! Warburton River !
** Indigofera brevidens. Peake !; Cooper Creek (*A. C. Gregory*).
·O.E. viscosa. Anna Creek !
O.E. hirsuta. Warburton River !
·O. Sesbania aculeata. Cooper Creek (*Howitt*).
Swainsonia phacoides. Warburton River !; south of Wills' Creek (*Howitt*); Innaminka !
** oligophylla. Cooper Creek (*A. C. Gregory*).
** campylantha. Cooper Creek (*A. C. Gregory*); Peake !; crabholes, Beresford Springs !
** phacifolia. John Creek !; Strzelecki Creek !
oroboides. Cooper Creek (*Howitt*).
procumbens. Between Hergott and Strangways !
** Glycine falcata. Cooper Creek (*Bowman*).
** sericea. Between Stokes' Range and Cooper Creek (*Wheeler*). Innaminka !
·O. tomentosa. Cooper Creek (*Howitt*).
·O.E. Æschynomene Indica. Beresford Springs !; seven miles from Strangways !

Digitized by Google

Vigna lanceolata. Anna Creek !

** Cassia pruinosa. Between Stokes' Range and Cooper Creek (*Wheeler*).

** pleurocarpa. West of Lake Eyre (— *Giles*).

phyllodinea. Between Hergott and Strangways !

eremophila. Warburton River !

** Sturtii. Peake !; Strzelecki Creek to Lake Frome !

* desolata. Innaminka !; Hamilton Creek, south end of Strzelecki !

* Petalostylis labicheoides. John Creek !

** Bauhinia Carroni. Towards Cooper Creek (*Howitt*).

** Acacia Peuce. North of Wills' Creek (*Howitt*).

** cyperophylla. Cooper Creek (*A. C. Gregory*).

** Murrayana. Cooper Creek (*Dr. Murray*).

tetragonophylla. South of Callana !

** Oswaldi, stenophylla } Cooper Creek (*Victorian Exped.*).

** Sentis. Strzelecki Creek !

** doratoxylon. Cooper Creek (*Herb. F.V.M.*).

T Farnesiana. Cooper Creek (*Victorian Exped.*).

ORDER CRASSULACEÆ.

A Tillæa verticillaris. Innaminka !

ORDER MYRTACEÆ.

** Melaleuca hakeoides. Cooper Creek (*Dr. Beckler*).

** trichostachya. Cooper Creek (*Howitt*).

** Eucalyptus microtheca. Cooper Creek (*Howitt*); Wooltana !

rostrata. Flooded watercourses, general.

ORDER HALORAGEÆ.

Haloragis ceratophylla. Warburton River !

ORDER LYTHRACEÆ.

O. E Ammannia baccifera. Cooper Creek (*Howitt*).

ORDER THYMELEÆ.

* Pimelea microcephala. Innaminka !; Strzelecki Creek !

** trichostachya. Innaminka !

ORDER PROTEACEÆ.

** Grevillea pterosperma. Cooper Creek (*Howitt*).

** juncifolia. North of Lake Eyre (*Sturt*).

striata. Cooper Creek (*Howitt*).

** nematophylla. William Tableland and south of Callana !

Digitized by Google

** Hakea leucoptera. Strzelecki Creek!; Cooper Creek (*Dr. Murray*).

ORDER LORANTHACEÆ.

Loranthus Exocarpi linophyllus } Cooper Creek (*Howitt*).
** gibberulus. William Tableland!
pendulus.
grandibracteatus. Cooper Creek (*Vict. Exped.*)
* Quandang. Cooper Creek (*Howitt*).
o. Viscum articulatum.

ORDER SANTALACEÆ.

Santalum lanceolatum. South of Callana!

ORDER UMBELLIFERÆ.

** Didiscus glaucifolius. Strzelecki Creek!
** Eryngium plantagineum. Innaminka; Strzelecki Creek; Paralana and John Creek!
Dauchus brachiatus. Strzelecki Creek!

ORDFR RUBIACEÆ.

** Oldenlandia tillæacea. Innaminka!; Strzelecki Creek!; Warburton River!
o. Dentella repens. Between Stokes Range and Cooper Creek (*Wheeler*).

ORDER COMPOSITÆ.

** Podocoma cuneifolia. Hamilton Creek!; between Hergott and Strangways!
Minuria leptophylla. Innaminka!; Strzelecki Creek!; Peake!
suædifolia. Stuart Creek (*Babbage*).
** integerrima. Warburton River!; Innaminka!
** denticulata. General, from Hergott to Peake!
Cunninghami. Between Hergott and Strangways!
** Calotis cymbacantha. Innaminka!; Strzelecki Creek!
erinacea. Nilpinna flats!; Innaminka!
lappulacea. Warburton River!
** plumulifera. Cootanoorrinna!; Innaminka and Strzelecki Creek!
** porphyroglossa. Innaminka!
hispidula. Innaminka!; Warburton River!; Peake!
Brachycome pachyptera. Innaminka!
ciliaris. Innaminka!; Strzelecki Creek!; Strangways!; Cootanoorrinna!
** melanocarpa. Innaminka!

Digitized by Google

Pterocaulon sphacelatus. Innaminka ! ; Hamilton Creek ! ; Peake !

Pluchea Eyrea. Strzelecki Creek ! ; Hergott to Strangways ! ; Nilpinna flats, between sandhills !

** Erodiophyllum Elderi. Strzelecki Creek and Wooltana !

FORMOSA. Epaltes australis. Innaminka !

Cunninghami. Warburton River !

** Pterigeron liatroides. Strangways (*Stuart*) ; Beresford Springs and Peake !

Flaveria australasica. Hergott ; Tableland north of Callana ; William Springs ; and Peake !

Med., S. Africa, Andean. } Cotula coronopifolia. John Creek !

** Centipeda thespidioides. Stuart Creek (*Babbage*) ; Strzelecki Creek !

o. orbicularis. Innaminka !

** Cunninghami. Strzelecki Creek !

** Myriocephalus Rudalli. Strzelecki Creek !

* Stuartii. Innaminka and Strzelecki Creek !

** Gnephosis eriocarpa. Innaminka ; Strzelecki Creek ; and Warburton River !

** codonopappa. Beyond Lake Eyre (*E. Giles*).

** arachnoidea. Strzelecki Creek !

Craspedia chrysantha. Innaminka !

pleiocephala.

** Calocephalus platycephalus. Strzelecki Creek !

** Rutidosis helichrysoides. Innaminka and Warburton River !

** Millotia Greevesii. Innaminka ! ; Peake !

Ixolæna tomentosa. Lake Eyre (*E. Giles*).

leptolepis. Hergott to Strangways ! ; Innaminka !

Podolepis canescens. Innaminka and Strzelecki Creek ! ; Warburton River !

rutidochlamys. Innaminka !

* Siemssenia. Strzelecki Creek ! ; Hergott to Strangways !

Leptorhynchos pulchellus. Strzelecki Creek !

Helichrysum apiculatum. Innaminka !

** semifertile. Innaminka ! ; Strzelecki Creek !

** podolepideum. Peake !

* Helipterum floribundum. Innaminka, ; Strzelecki Creek ; and Peake !

** pterochætum. Stuart Creek (*Babbage*).

** strictum. Warburton River ! ; Stokes' Range to Cooper Creek (*Wheeler*).

moschatum. Innaminka ; Strzelecki Creek ; Peake ; and Warburton River !

corymbiflorum. Innaminka and Strzelecki Creek !

Digitized by Google

Helipterum incanum. Warburton River !
exiguum. Strzelecki Creek !
hyalospermum. Innaminka !
** Senecio Gregori. Warburton River; Innaminka; and Strzelecki Creek !
lautus. Innaminka !; Hergott to Strangways !
brachyglossus. Warburton River !; Innaminka !
* Cunninghami. Warburton River and Innaminka !
cos. Gnaphalium luteo-album. Innaminka and Strzelecki Creek !

ORDER CAMPANULACEÆ.

Lobelia Benthami. Cooper Creek (*Bowman*).
** Isotoma petræa. John Creek and Tooth-knob, Lake Frome !
o. Wahlenbergia gracilis. Innaminka; Strzelecki Creek; and Warburton River !

ORDER GOODENOVIEÆ.

** Leschenaultia divaricata. Cooper Creek (*Wheeler*); Anna Creek !
Goodenia glauca. Warburton River !; Strzelecki Creek !; Strangways !; Peake !
** cycloptera. Peake !; Warburton River !
** Mitchelli. Lake Eyre (*E. Giles*).
** heteromera. Strangways !
** microptera. Warburton River !
* Scævola spinescens. Innaminka !; Strzelecki Creek !
** depauperata. Cooper Creek (*Wheeler*).
** collaris. Lake Eyre (*E. Giles*); Warburton River !
* ovalifolia. Strzelecki Creek !; Cooper Creek (*Howitt*); Lake Eyre (*Lewis*).

ORDER GENTIANEÆ.

LOOCHOO. Erythræa australis. Innaminka and Strzelecki Creek!

ORDER PLANTAGINEÆ.

Plantago varia. Warburton River !; Innaminka !

ORDER ASCLEPIADEÆ.

** Cynanchum floribundum. Cooper Creek (*Howitt*).
** Marsdenia Leichhardtiana. John Creek !
* Sarcostemma australis. Tableland around Lake Eyre !

ORDER SOLANACEÆ.

cos. Solanum nigrum. Hergott to Strangways !
* esuriale. Hergott to Strangways !
** chenopodinum. Cooper Creek (*Howitt*).
** Sturtianum. Innaminka and John Creek !

Digitized by Google

* eremophilum. Hergott to Strangways!; Beresford Springs!; Peake!
** lacunarium. Lake Eyre (*E. Giles*).
* ellipticum. Innaminka!; Peake!
** orbiculatum. Warburton River!
Nicotiana suaveolens. Warburton River!; Innaminka!; Strzelecki Creek!; Peake!

ORDER SCROPHULARIACEÆ.

** Mimulus prostratus. Strzelecki Creek!
* Stemodia Morgania. Warburton River; Innaminka, and Strzelecki Creek!
** Peplidium Muelleri. Lake Eyre.

ORDER ACANTHACEÆ.

T Justicia procumbens. Innaminka!; Strzelecki Creek!; Peake!

ORDER PEDALINEÆ.

** Josephinia Eugeniæ. Near Cooper Creek (*Bowman*).

ORDER CONVOLVULACEÆ.

Convolvulus erubescens. Innaminka!
T Evolvulus linifolius. Cooper Creek (*Howitt*).
** Breweria media. Cooper Creek.
** Polymeria longifolia. Cooper Creek.
** angustata. Cooper Creek.

ORDER OROBANCHACEÆ.

Orobanche australiana. John Creek, Lake Frome!

ORDER BORAGINEÆ.

O.E. Coldenia procumbens. Cooper Creek (*Howitt*).
S. Africa, N. and S. America. Heliotropium Curassavicum. Warburton River!; John Creek!
MED. undulatum. Near Lake Eyre (*Lewis*).
* asperrimum. Beresford Springs! Hergott to Strangways!; John Creek!
O.E. ovalifolium. Innaminka!
** filaginoides. Cooper Creek (*Howitt*).
Halgania cyanea. Innaminka!
O.E. Pollichia Zeylanicum. Cooper Creek (*Howitt*); Strzelecki Creek!
Echinospermum concavum. Stokes' Range to Cooper Creek (*Wheeler*).
* Cynoglossum Drummondi. Innaminka and Strzelecki Creek!

Digitized by Google

ORDER LABIATÆ.

Mentha australis. Innaminka, Strzelecki Creek, and north of Strangways !

** Prostanthera striatiflora. Towards Cooper Creek (*Wheeler*); Wooltana !

Teucrium racemosum. Warburton River !; Cooper Creek (*Howitt*); Strangways and Beresford Springs !

ORDER VERBENACEÆ.

* Verbena macrostachya. Warburton River, Innaminka and Strzelecki Creek !

** Newcastlia spodiotricha. Eyre Creek (*Kayser*).

ORDER MYOPORINEÆ.

Myoporum Cunninghami. Strzelecki Creek !

** Eremophila Dalyana. Stokes' Range to Cooper Creek (*Wheeler*).

** Sturtii. Hamilton Creek !

** Latrobei. Cooper Creek (*Howitt*); Cootanoorrinna !

** MacDonnelli. Strzelecki Creek !; Paralana !

** Freelingi. Innaminka !; Strzelecki Creek !; Cootanoorrinna !; Peake !

** Goodwini. Stokes' Range to Cooper Creek (*Wheeler*); beyond Lake Eyre (*E. Giles*).

** Duttoni. Cooper Creek (*Wright*).

** polyclada. North-east of Lake Eyre (*Sturt*).

** maculata. Strzelecki Creek !; Innaminka !; Lake Eyre (*E. Giles*).

Brownii. Innaminka !

** latifolia. North of Strangways Springs !

** bignoniflora. Strzelecki Creek !

** Bowmani. Cooper Creek !

* scoparia. South of Callana !; about Lake Eyre (*E. Giles*).

ORDER ORCHIDEÆ.

Cymbidium canaliculatum. Cooper Creek (*Herb. F.v.M.*).

Caladenia deformis. Strzelecki Creek !

ORDER AMARYLLIDEÆ.

** Crinum flaccidum. Cooper Creek (*Vict. Exped.*); Strzelecki Creek !

Calostemma luteum. Mount Margaret (*Stuart*); Cooper Creek (*Neilson*).

Digitized by Google

ORDER LILIACEÆ.

Wurmbea dioica. Between Lake Eyre and River Finke (*E. Giles*).

Bulbine semibarbata. Warburton River!; Innaminka!; John Creek!

Tricoryne elatior. Cooper Creek (*Vict. Exped.*).

** Thysanotus exiliflorus. Innaminka!

ORDER NAIADEÆ.

Triglochin centrocarpa. Warburton River!

ORDER JUNCACEÆ.

Juncus planifolius. Strzelecki Creek!

ORDER CYPERACEÆ.

Cyperus gracilis, subulatus } Lake Eyre (*Andrews*).

fulvus. Beresford Springs!

o eragrostis. Strzelecki Creek!

** Gilesii. Innaminka!

o difformis. Beresford Springs!

o.e. Iria. Beresford Springs!; Innaminka!

t Fimbristylis ferruginea, velata } Warburton River!

cos Scirpus lacustris. John Creek!

cartilagineus. Innaminka!

ORDER GRAMINEÆ.

** Panicum reversum
** coenicolum
W. Indies adspersum
o distachyum } Near Lake Eyre (*Andrews*).

o.e. Panicum helopus. General on west side of Lake Eyre!

decompositum. Lake Eyre (*Andrews*); Cooper's Creek (*Howitt*).

t. leucophœum. Cooper Creek (*Vict. Exped.*).

Mitchelli. Cooper Creek (*Howitt*).

effusum. Hergott to Strangways!

o.&c. Setaria viridis. Anna Creek and tableland near Strangways Springs!

** Pennisetum refractum. Cooper Creek (*Howitt*).

** Spinifex paradoxus. Near Lake Eyre (*Andrews*); Warburton River!

o. Eriochloa annulata. Cootanoorrinna, and generally about west side of Lake Eyre!

o. Perotis rara. Towards Cooper Creek (*Neilson*).

Digitized by Google

o.&c. Lappago racemosa. Hergott to Strangways!; Warburton River!
Erianthus fulvus. Anna Creek!; near Lake Eyre (*Andrews*).
o. Andropogon punctatus. Callana!
o. sericeus. Lake Eyre (*Andrews*).
exaltatus. Callana!; Lake Eyre (*Andrews*).
** Anthistiria membranacea. Cootanoorrinna, and general on west side of Lake Eyre!
o.e. ciliata. West side of Lake Eyre!
** avenacea.
Aristida stipoides. Strzelecki Creek!; Lake Eyre (*Andrews*).
arenaria. Warburton River!
Stipa semibarbata. Innaminka!
Pappophorum commune. Hergott to Strangways!; Beresford Springs!; Warburton River!
** Astrebla pectinata. Hergott to Strangways!
** triticoides. Lake Eyre (*Andrews*).
Triraphis mollis. General on west side of Lake Eyre!
** Chloris acicularis. Anna Creek!
o.&c. Eleusine cruciata. Hergott to Strangways!
* Sporobolus Lindleyi. General on west side of Lake Eyre!
** actinocladus. Cootanoorrinna!
** Eriachne aristidea. Lake Eyre (*Andrews*).
ovata. Lake Eyre. (*Andrews*).
Eragrostis concinna. Lake Eyre (*Andrews*).
speciosa. Hamilton River (*Stuart*).
** laniflora. Beresford Springs!
** chætophylla
** lacunaria } Lake Eyre (*Andrews*).
** falcata
** trichophylla. Hergott to Strangways!; Cootanoorrinna!
sp. Anna Creek.
T. Festuca fusca. Lake Eyre (*Andrews*).
* Trodia irritans. General on stony and sandy ground!
** Poa ramigera. Anna Creek!

ORDER MARSILEACEÆ.

MED. Marsilea quadrifolia. Innaminka!; Strzelecki Creek!

ORDER FILICES.

O. Cheilanthes tenuifolia. Innaminka!; Mount Nor'-West!
MED. vellea. Innaminka!; Lake Eyre (*Andrews*).
MED. A. Grammitis rutæfolia. Innaminka!; Mount Nor-West!
COS. Ophioglossum vulgatum. Strzelecki Creek!

Digitized by Google

On Some New South Australian Coccidæ.

By W. M. Maskell, F.R.M.S.

[Read July 3rd, 1888.]

Plates XII. to XIV.

The following paper contains detailed descriptions of some insects which Mr. F. S. Crawford, of Adelaide, has kindly sent to me. They are all, in various ways, interesting, and some of them are quite peculiar. It would be desirable that some systematic investigations should be made amongst the Australian Homoptera. This field has hitherto been very little worked, and, from these and other specimens which have come under my notice, I believe that a student of this very curious Order will find in Australia ample opportunities for most interesting work. All these insects have some peculiar features of their own well worth examination. If nobody in their native country cares to undertake the task, I shall be very happy to do what I can if specimens are sent to me.

On this I may mention, as a guide both to those who would like themselves to study Coccids and to those who might be good enough to send insects for identification, that two things are necessary. First, care must be taken to procure specimens, if possible, in all stages of existence; secondly, attention should be directed by a student to the determination of minute points of anatomy. The first is required because a Coccid, in very many cases, is quite different in different states of life; the female is quite unlike the male, the larva is often no guide whatever to the form of the adult. The second is requisite because, without minute examination, errors may very easily arise; for example, *Monophlebus Crawfordi*, herein described, in outward appearance very closely resembles, as to the female, *Cœlostoma Zealandicum*, and, as to the male, *Icerya Purchasi*. The minute rostrum of the female and the tassels of the male are distinguishing characters, to be made out only with a strong lens or the microscope. These remarks may perhaps seem to some superfluous, yet they contain points of the greatest importance for the study of Homoptera, especially Coccids.

Digitized by Google

FAMILY COCCIDIDÆ.

GROUP—DIASPIDINÆ.

Genus—Aspidiotus, *Bouché.*

Female puparium varying in colour, circular in outline, usually flat, sometimes rather convex; pellicles central.

Male puparium elongated, not carinated; pellicle at one end.

Aspidiotus eucalypti, sp. nov. Plate xii., fig. 1.

Female puparium (figs. 1 and *a* and *b*), circular, slightly convex, dirty-white in colour; diameter averaging $\frac{1}{12}$ inch. The pellicles in the centre are very inconspicuous.

Male puparium *(c)* narrow, elongated, semi-cylindrical; colour white, the pellicle yellow; not carinated above. Length nearly $\frac{1}{18}$ inch.

Adult female (*d*) of the usual pegtop-shape of the genus, but with a deep transverse groove about one-third of the distance from the cephalic extremity, which divides it into two unequal portions. The other segments are not conspicuous. Colour dark brown. The abdomen is not overlapped by the anterior segments as in some species. Length, $\frac{1}{18}$ inch; diameter almost the same. Abdomen (*e*) ending in two median lobes, and at each side some short fine hairs. No groups of spinnerets, but rows of spinnerets are arranged along the last three segments, and there are a few others scattered. After pressure, as shown in the figure, the pygidium is seen to extend for some distance within the edge of the abdomen, and is of a bright yellow.

Adult male not known.

The puparia of the females are found thickly aggregated in masses on the bark, with the males interspersed.

This species is clearly distinguished by the deep transverse groove on the female, as shown in figs. *b* and *d*. The male puparium is also narrower, and more cylindrical than usual.

Habitat.—On Eucalyptus (various kinds), South Australia; often found intermingled with the next insect, *Chionaspis assimilis.*

Genus—Chionaspis, *Signoret.*

Female puparium usually, but not always, white; elongated, generally nearly flat; pellicles at one end.

Male puparium elongated, white, carinated; pellicle at one end.

Chionaspis assimilis, sp. nov. Plate xii., fig. 2.

Female puparium (figs. 2 and *a* and *b*) elongated, pyriform, slightly curved, scarcely convex; colour dark brown, the pellicles at one end yellow. Length, about $\frac{1}{10}$ inch.

Digitized by Google

Male puparium (*c*) brownish-white, narrow, semi-cylindrical; pellicle yellow. Length, $\frac{1}{16}$ inch.

Adult female (*d*) of the usual elongated form of the genus, the cephalic region smooth, the abdomen with conspicuous segments; colour brown. Length, about $\frac{1}{15}$ inch. The abdomen (*e*) ends in two median lobes with at each side a few spines; pygidium exhibiting five groups of spinnerets, but only two or three in each group.

The larva (*f*) is of the normal form of the Diaspid group, but the rostrum, as shown in the figure, appears to be abnormally large.

Habitat.—On Eucalyptus (various), South Australia.

This insect approaches very nearly *C. euonymi*, Comstock (Report of the Entomologist, U.S. Dept. of Agric., 1880, p. 313), especially in the small number of spinnerets in the groups; but it differs in colour in the lobes of the abdominal extremity, and in the absence of a "ventral scale" in the puparium.

Group—Lecanidinæ.

Subdivision—Lecanidæ.

Genus—Pulvinaria, *Targioni.*

Female insects naked, arboreal, constructing a cottony ovisac: exhibiting an abdominal cleft and dorsal lobes at all stages. Male pupæ in cottony or waxy tests.

Pulvinaria flavicans, sp. nov. Plate xii., fig 3.

Adult female (figs. 3 and *a*), yellowish-brown in colour, not globular or gall-like, but slightly convex, rugose; outline sub-elliptical; naked, but producing a quantity of white cotton, which surrounds its edges, looking like a cushion on which the insect reposes; but on turning it over the ventral surface is seen to be bare, so that the insect rests rather on a ring of cotton. General form normal of the Lecanid group, exhibiting the abdominal cleft and dorsal lobes, but the cleft (*b*) is shallow and wide. Round the edge of the body is a row of spines, short and not very close together. Antennæ of apparently eight joints (*c*), but the division shown in the figure at *c* may be a "false joint," as in some other Lecanidæ, and the antenna may have really seven joints. Assuming eight as the number, all the joints are sub-equal in length, with a few short hairs; on the last joint is one hair about three times as long as the others. Feet (*d* and *e*) with somewhat thick femur, the tibia and tarsus slender; upper pair of digitules, with long, fine, knobbed hairs, lower pair rather longer than the claw, and slightly dilated at the tips. Anogenital ring *(f)* with many hairs. Rostrum short and thick:

Digitized by Google

mentum monomerous. On the ventral surface are many spinnerets, narrow projecting tubes, which are most numerous at the edges and near the posterior extremity.

Second stage of female not observed.

Larva (*g*) active; body elongated, very indistinctly segmented; colour brownish-yellow. Abdominal cleft and dorsal lobes present. The lobes are somewhat long, so that some larvæ seem almost to have anal tubercles; setæ long and thick. Antennæ (*h*) rather disproportionately large, with six joints, of which the third is the longest, the rest sub-equal; one or two short hairs on most of the joints, and one the last, which is fusiform, several hairs, of which one is very long, almost equal in length to the whole antenna. Feet also large and long, all the joints thick; the tibia is longer than the tarsus (an exceptional character in a larva); digitules, both upper and lower. Knobbed hairs. Anogenital ring (*i*) with eight hairs. A few short spines round the edge of the body.

Male in all stages unknown, but on the twig examined, amongst a number of females, there were a few empty, broken, glassy tests, of the usual form of Lecanidæ; these seem undoubtedly the tests of male pupæ.

This appears to be clearly a *Pulvinaria*, and differs in a few particulars from described species. The cottony ovisac is shorter and more ring-shaped than usual in the genus. But the species of *Pulvinaria* have not been diagnosed with sufficient completeness. *P. vitis*, Linn., *P. artemisiæ*, Licht., and *P. oxyacanthæ*, Linn., exhibit characters found in the South Australian insect.

Group—Coccidinæ.

Subdivision—Acanthococcidæ.

Genus—Eriococcus, *Targioni-Tozzetti.*

Adult females enclosed in a sac of felted cotton; body elongated, segmented; anal tubercles conspicuous.

Amongst the characters hitherto ascribed to this genus are an elongation of the sac and a number of spines on the dorsum, and the sac is usually so clearly cottony as to present no difficulties. The insect about to be described is abnormal in both particulars, but other characters seem to place it in this genus—indeed, it agrees with no other—and it is therefore so allocated here. It presents several features of considerable interest.

Eriococcus paradoxus, sp. nov. Plate xiii., fig. 4.

Sac of adult female (figs. 4 and *a*) dark reddish brown, circular, convex, aggregated in masses on the bark, and so thickly covering it sometimes as probably to smother the plant; diameter about

Digitized by Google

$\frac{1}{8}$ inch. The aggregated mass is so thick that on cutting a vertical section it appears like a honeycomb of cells (*b*), each containing an insect. At the summit of the convex sac is a very minute orifice (not apparent in every instance). This orifice (shown in fig. *a*) is probably intended to give access to the male insect, specimens of which may sometimes be found inside the cellular sacs with the females. The sac is so closely fitted that it has quite the appearance of being waxy instead of cottony, but a little pressure with the point of a pencil makes an impression in it as if it were leathery; and on boiling in potash it becomes dissolved, which is not the case with any waxy coccid test, as far as I know. The spinnerets and threads described below are also evidences that the sac is really felted, though very closely.

The sac of the male (*c* and *d*) is reddish-yellow, narrow, elongated, convex above and flat beneath; after its last metamorphosis the male escapes by an orifice at one end.

Adult female (*e*) somewhat pegtop-shaped, the cephalic region large and smooth, the abdomen small, segmented and tapering to the two anal tubercles, which are prominent, and bear each a long seta. Colour dark reddish-brown; length, exclusive of the tubercles, about $\frac{1}{10}$ inch. On maceration and boiling in potash the anatomical details can be made out. On the cephalic region, as shown in the diagram (*f*), there are four bands of very small, circular spinneret orifices (shown enlarged in fig. *g*); these bands correspond with the position of the four stigmata of the body. On the abdominal segments there are rows of double, or figure-of-eight, spinnerets (fig. *h*, and enlarged fig. *i*); many of these also are scattered over the cephalic region. From these double spinnerets spring long white curling threads (*k*, *l*), which form the felted sac. The rostrum (*m*) is conical, and the mentum (*n*) is bi-articulate. The antennæ (*o*) are atrophied and very short; the number of joints cannot be clearly made out, owing to compression, which confuses them; but the normal number in the genus is six, and probably this is the case here also. The tip bears a few strong short hairs. The feet are entirely absent.

The second stage of the insect has not been observed.

The larva, just after leaving the egg, is of the normal shape of the genus (*p*)—elongated, flattish, tapering slightly posteriorly; exhibiting the anal tubercles. Colour reddish; length about one-fortieth of an inch. Antennæ (*q*) of six sub-equal joints, all slightly dilated at the end except the last, which is irregular and pointed, and bears some hairs; all the joints appear to be numerously ringed. Feet normal. On the body there are four longitudinal rows of figure of eight spinnerets (*r*). The anal tubercles bear long setæ.

Adult male (*s*), red; somewhat short and squat; the thorax

Digitized by Google

broad, and the abdominal segments compressed. Length of the body, about one-fortieth of an inch. The last segment of the abdomen bears on each side three longish setæ. Antennæ (*t*) of ten joints, the first very short, the rest sub-equal, elliptical, except the second, which is dilated at the tip; all the joints bear hairs. Feet (*v*) slender; upper digitules long and slender, lower pair short; fine hairs. Abdominal spike (*w*) conical, pointed.

Habitat.—On Pittosporum undulatum. South Australia.

This is an anomalous and peculiar insect, and if the joints of the antennæ, in the adult female, have really more than six joints, as they may well have, it must be removed from the genus *Eriococcus*. The absence of the feet is also an abnormal character. In general outline the female resembles the New Zealand insect *Eriococcus hoheriæ*, but in that the feet are present, though atrophied.

Group—Coccidinæ.

Subdivision—Dactylopidæ.

Genus—Ripersia, *Signoret.*

Adult females stationary, excreting much white meal and cotton; antenuæ of six joints; anogenital ring with six hairs; anal tubercles present but, in the adult, not conspicuous.

Ripersia leptospermi. sp. nov. Plate xiv., fig. 5.

Adult female flattish, a little raised and carinated on the dorsum; outline sub-circular, or if in a depression of the leaf proportionately compressed; colour dark purple, covered with white meal; producing rich red colour when immersed in potash. From the edge of the body radiate all round a large number of very long, fine, white, cottony, curling filaments which are also slightly arched, forming a kind of bower, under which is a mass of more granular cotton, slightly tinged with yellow, in which the eggs are laid and hatched. The filaments are in tufts set close together, and their average length is about twice the diameter of the insect. Antennæ (*a*) of six joints, of which the two first are very short, the last three sub-globular and sub-equal, and the third nearly half as long as the whole antenna; on the last joint are a few short conical bristles, on the third are two hairs, and one or two hairs on the rest. A "false joint" occurs on the third joint, as in some Lecanidæ. Feet (*b*) very long and slender; the tibia very little longer than the tarsus; claw slender; upper digitules long knobbed hairs, lower digitules short and very fine. Rostrum (*c*) short; mentum dimerous. The body has twelve inconspicuous segments, and at the edge is a row of twenty-four groups of large projecting tubular spinnerets with wide bases (two to each segment), from which spring the tufts of long, white, cottony

Digitized by Google

filaments (figs 1 and *d*). On the epidermis are other spinneret orifices, circular and not projecting, from which the yellower cottony mass is excreted. Anal tubercles inconspicuous with short setæ. Average diameter of the body, $\frac{1}{30}$ inch; average diameter from tip to tip of the cottony filaments, $\frac{1}{8}$ inch.

Second stage of the female not observed.

Larva just hatched (*e*) active, elongated, dark purple in colour, slightly dusted with white meal; body segmented; anal tubercles conspicuous, with long setæ. Antennæ (*f*) of probably four joints, but the joints are not easily distinguished. Feet thick, apparently normal. Length of body, about one-fiftieth of an inch.

Male in all stages unknown.

This insect is evidently a Dactylopid, from the character of the anal tubercles, the six-haired anogenital ring, and the general form of the adult female. It is referred to the genus *Ripersia*, on account of the six-jointed antennæ. Only one species of the genus appears to have been described hitherto (*R. corynephori*, Signoret); but this seems to have nothing like the arched fringe of long white cottony filaments, and its colour is yellow. Other distinctions are in the form of the antennæ, the digitules of the foot, and the character of the spinnerets. The South Australian insect appears to be clearly distinct.

Group—Coccidinæ.

Subdivision—Monophlebidæ.

Hitherto a distinguishing character of this subdivision has been the possession of ten or eleven joints in the adult female. For this reason Signoret expressed doubts whether the specimens observed of the insect *Drosicha contrabens*, Walker (from Ceylon), which had only nine joints, were really adult females; and, having in view these doubts, I attached, in my "Scale Insects of New Zealand," the genus *Drosicha* with *Monophlebus*. It is quite clear, from the following account of a new species, that the subdivision must be extended as regards this character, and perhaps *Drosicha*, when again observed, may be found to be really as Walker originally described it.

Genus—Monophlebus, *Leach*.

Adult female with nine (or eleven?) joints in the antennæ; adult male with several long tassels on the abdominal segments.

A curious point about this is that, whilst all authors give generic characters for the females of *Monophlebus*, not one seems to have ever described, or perhaps observed, a female, at least so far as to determine its more minute features. Westwood and Leach possessed apparently specimens; and from their general

Digitized by Google

outward similarity to the females of *Porphyrophora*, *Guerinia*, &c., probably the eleven-jointed antennæ has been taken for granted. The males of several species of *Monophlebus* are described, chiefly as inhabiting the East Indies. In *Cœlostoma*, an allied New Zealand genus, the antennæ have undoubtedly eleven joints; so also in *Icerya*. As far as I know, the following is the first published *detailed* description of a female *Monophlebus*, and it is interesting, as it necessitates the revision just noted of the characters of the genus.

Monophlebus Crawfordi, sp. nov. Plate xiv., fig. 6.

Adult female (figs. 1, *a* and *b*) brick-red in colour, with two broad longitudinal stripes of purple extending the whole length on the dorsal side and on the abdominal segments beneath. The body is slug-like, fat, and distinctly segmented with twelve divisions; somewhat convex above and flat beneath. The cephalic and thoracic region occupies half the length, so that the feet seem placed rather in a forward position, and the insect crawls slowly. There is a quantity of white, short, cotton covering the insect, and at gestation this is heaped in large masses containing the eggs. The antennæ (*c*) are tapering, with nine joints, the first and second are wider and shorter than the rest which are sub-equal except the last which is elongated oval; each joint bears some hairs. At the base of the antenna is situated the eye (shown in fig. *c*); this is small, tubercular, not facetted but with a central orifice or spot. The feet (*d*) are not very strong; the tibia is more than twice as long as the tarsus; the trochanter bears one long seta; all the joints have hairs, and on the under-side of the tibia is a series of short spiny hairs or bristles; the upper digitules appear to be absent, the lower pair being short, fine hairs. The rostrum is very minute, but may be clearly made out in a deep hollow between the anterior pair of feet (it is indicated in fig. *b*); it is conical (*e*) and appears to have no mentum. At the tip there are some short hairs, but no long setæ, as in most coccids. The body of the insect is covered with short, fine, spiny hairs, intermingled with small circular spinneret-orifices.

The second female stage has not been sent to me. Judging by analogy, this will probably be found (as in the allied New Zealand genus *Cœlostoma*) to be encased in a large waxy test, and stationary on some plant. But, unless searched for by some one more or less familiar with the peculiar variations of coccids, which are generally not a little puzzling, it may not be found for some time; and analogy may be misleading, so that this second stage may really be something resembling the adult. It would be interesting to clear up the doubt, the metamorphoses of coccids being one of the most curious features of the family.

Digitized by Google

The adult male (*f*) is a fine insect, rather larger than usual amongst coccids, the body measuring almost $\frac{1}{9}$ inch and the expanded wings $\frac{2}{5}$ inch. It is not, at first sight, unlike the male of the allied genus *Icerya* (*I. Purchasi*, the cottony-cushion scale), having a red body and dark-brown wings. But the characteristic feature of the genus *Monophlebus* is the presence of a number of tassels on the abdomen—two on the last segment but one, and four on the last segment (*g*). In the figure one of the tassels is shown as cut off. The head, thorax, and abdomen are red, with darker patches; the thorax smooth, the abdomen cylindrical and segmented. On each segment are a few hairs, and each of the tassels bears several long setæ. The eyes are prominent, dark-brown, and conspicuously facetted. The wings are large, brown, with a strong red, bifurcated nervure, and two longitudinal whitish streaks or hyaline bands. The halteres are thick and inflated, with four seta-like hooks. Antennæ (*f* and *h*) long and rather stout, with ten joints, each of which is constricted in the middle, and may be easily mistaken for two. Each joint bears two rings of very long fine hairs. Feet (*i*) long and slender; the trochanter has a long seta; tibia more than twice the length of the tarsus; upper digitules absent, lower pair fine hairs. There are no ocelli on the head.

This is a very interesting insect for several reasons, the first of which may be that, as far as my information extends, the females of *Monophlebus*, as noted above, have not yet been described. The males of seven species are given in Dr. Signoret's work, the descriptions being taken verbatim from Westwood's "Arcana Entomologiæ," 1841; and nobody else seems to have examined or described the genus. Of these seven one (*M. Illigeri*) is given as from "Van Diemen;" in size it nearly agrees with our insect, the male being about $\frac{1}{8}$ inch long, with $\frac{2}{5}$ inch expansion of wings; but it [the male] is said to be "nigricans, pedibus nigris," and to have tassels on each abdominal segment. These old descriptions, especially in the absence of any notice of the females, are too vague for identification. Westwood assigns 22 joints to the antenna of the male *M. Illigeri*. He had evidently examined it only with a lens, and failed to see the constriction in each joint.

The female *M. Crawfordi* resembles very much in outward appearance the New Zealand insect *Cœlostoma Zealandicum*, and my friend Mr. Crawford sent it to me as of that genus. But the presence of a distinct rostrum, which can easily be seen although it is very small, quite removes it from *Cœlostoma*; and I have pleasnre, whilst ascribing it to its proper genus, in connecting it with his name. Of proper habitat, it cannot well be said to have any, as it crawls about freely, though slowly. Probably, as stated above, the second female stage may be some day found to be stationary on some plant in waxy tests.

Digitized by Google

I should observe that, if the characters of Monophlebus hitherto given were correct, the insects above described, having only nine joints in the female antenna, could not be adult. But, in the first place, the whole appearance of the female, its free locomotion, its cottony envelope, its general form, all point clearly to its adult state. Secondly, and this is most important, the tibia is a great deal longer than the tarsus: and this, all through the Coccid family, with the exception of a very few genera, is only the case in the adult. I should be very much surprised if the female I have been describing ever turns out to be anything but full-grown.

PARASITES.

Coccids are greatly subject to attacks from parasitic enemies, chiefly Hymenoptera, sometimes Diptera. If it were not so, their ravages, which are quite bad enough as it is, would be entirely destructive; the parasites keep them very much in check. Amongst the insects described in this paper two clearly show parasites. I found five dead female *Aspid. eucalypti*, each containing the pupa-case of a hymenopterous parasite which had emerged and flown away; and Mr. Crawford has sent me four female *Monophlebus*, which are literally riddled like sieves with holes from which small dipterous flies have emerged. In New Zealand I have never yet found more than one parasite in a Coccid; these South Australian insects evidently can harbour many; I counted 69 holes in one *Monophlebus*. These flies appear to be of the same kind as that which Mr. Crawford has reported as killing *Icerya Purchasi*; but I am not sufficiently acquainted with the Diptera to identify them. The group Monophlebidæ (always excepting *Icerya*) are not, I think, injurious insects; and if they will breed numbers of parasitic flies which may also attack other and worse pests than they are, they might even be encouraged, if possible.

EXPLANATION OF PLATES XII. TO XIV.

PLATE XII.

Fig. 1. *Aspidiotus eucalypti*, sp. nov. Insects male and female in puparia on bark of eucalyptus; nat. size.
- *a*. Female puparia, upper side.
- *b*. Female puparium, underside with female.
- *c*. Male puparia, upper side.
- *d*. Adult female.
- *e*. Abdomen and pygidium of female with spinnerets.

Fig. 2. *Chionaspis assimilis*, sp. nov. Insects male and female in puparia on bark of eucalyptus; nat. size.
- *a*. Female puparium, upper side.
- *b*. Female, under side with female.
- *c*. Male puparia, upper side showing carination.
- *d*. Adult female.
- *e*. Abdomen and pygidium of do. with spinneret groups.
- *f*. Larva underside, showing rostrum.

Digitized by Google

Fig. 3. *Pulvinaria flavicans*, sp. nov. Females with cottony secretion on twig (shrub undetermined); nat. size.
a. Diagram of adult female.
b. Diagram of abdominal cleft and dorsal lobes of ditto.
c. Antenna of ditto, showing doubtful joint at *c*.
d. Foot of ditto.
e. Claw and digitules of ditto.
f. Anogenital ring of ditto.
g. Larva.
h. Antenna of ditto.
i. Anogenital ring of ditto.

PLATE XIII.

Fig. 4. *Eriococcus paradoxus*, sp. nov. Insects male and female, in sacs on twig of Pittosporum; nat. size.
a. Sacs of female, upper side, showing orifice.
b. Vertical section of aggregated mass of sacs, with insects.
c. Sac of male.
d. Ditto, showing orifice of escape.
e. Adult female.
f. Ditto, diagram to show stigmatic spinnerets.
g. Stigmatic spinnerets.
h. Abdomen of female, showing tubercles and spinneret-bands.
i. Abdominal spinnerets.
k, *l*. Threads from ditto.
m. Rostrum.
n. Mentum with setæ.
o. Antenna of female.
p. Larva; dorsal view; diagram to shows spinnerets.
q. Antenna of ditto.
r. Spinneret of ditto.
s. Adult male.
t. Antenna of ditto.
v. Foot of male.
w. Abdominal spike and setæ of ditto.

PLATE XIV.

Fig. 5. *Ripersia leptospermi*, sp. nov. Diagram of adult female after maceration and pressure; enlarged twelve diameters.
a. Antenna of ditto.
b. Foot of ditto.
c. Rostrum of ditto.
d. Spinnerets of ditto.
e. Larva.
f. Antenna of ditto.

Fig. 6. *Monophlebus Crawfordi*, sp. nov.
a. Adult female, dorsal side, enlarged two diameters.
b. Ditto, under side showing rostrum, enlarged two diameters.
c. Antenna and eye of female.
d. Foot of female.
e. Rostrum of ditto.
f. Adult male.
g. Abdomen of male, showing tassels (one cut off).
h. Three joints of antenna of ditto.
i. Foot of male.

NOTE.—Mr. Maskell's drawings being in colours, the plates are photo-lithograph copies of them made by Mr. F. S. Crawford.

Digitized by Google

On Measuring the Power of Telescopic Eyepieces.

By D. B. Adamson.

[Read February 1st, 1887.]

In the course of my telescopic observations I have made a point of inquiring of parties, when they have been observing the moon, what they considered the apparent diameter of that luminary to be when viewed with the naked eye. I have found the variety of opinions on this subject to be very surprising.

One old gentleman informed me that to him the moon appears to be rather over six feet in diameter; while another friend says it looks the size of a dinner-plate; and another tells me it seems about the size of a saucer; while another gives the size of an onion as the moon's apparent diameter. Now these different answers, although so various, might each and all of them be correct, as the apparent magnitude of any object depends entirely on the distance at which that object is viewed; so that if a six-feet rod or the dinner-plate, the saucer, or the onion, were placed between the moon and the eye of the observer, and each at such a distance that it would exactly cover that luminary from view, then their apparent magnitudes would, of course, be equal. But for this purpose those articles would require to be placed at such a distance from the observer that they could not be distinctly seen by the unassisted eye.

When a person of normal eyesight wishes to examine any small object minutely he holds it at a distance of about eight inches from his eye, and we find, if we hold a threepenny-piece at this distance, it far more than covers the whole of the moon's disc, and I find when I hold the blade of my penknife at this distance, it quite eclipses the moon. Now the width of that blade is not six feet, but only about three-sixteenths of an inch.

In showing persons the heavenly bodies in a telescope, they are very often sceptical about the magnifying powers, and when they are informed that the power they are using gives, say, one hundred diameters, they will say, "Certainly the object is exceedingly sharp and distinct, and seems so near that you feel as if you could put your finger on it. But surely it is not magnified so much?"

To convince anyone of the magnifying power, if the instrument be a "refractor," we have only to tell him to look into the tele-

Digitized by Google

scope with one eye, and compare the moon as seen there with the same object as seen with the other and unassisted eye, and he will very soon be convinced, for with a little manipulation the moon, as seen by the naked eye, may be brought over the magnified image as seen in the telescope, when it will be found that the former appears so small that it might be put into one of the craters of the latter.

To perform the same experiment with my "Newtonian Reflector," I have constructed a small metallic speculum, which can be slipped on to the eye-piece tube, and can be turned to any required angle, so that the object as seen by the naked eye can be brought over the magnified image in the telescope. When the instrument with a power of 108 is turned on the Post-office clock we find that the whole diameter of the tower as seen in the plane reflector occupies only about the space of one of the minutes marked on the circumference of the dial as seen in the telescope. By methods such as these we can convince the most sceptical that telescopes do magnify, but for those who use telescopes for scientific observation it is absolutely necessary that they should know the magnifying powers of their instruments with the greatest possible precision. For this purpose several methods may and have been adopted. As the magnifying power of any telescope depends entirely on the magnitude of the angle under which any object is presented to the eye in the eye-piece of the instrument, and as this angle can at once be found by dividing the focal length of the object glass or the speculum by that of the eye-piece employed, this might seem a very simple way of getting at the exact power; and indeed it is fairly satisfactory as far as low powers are concerned, or with single-lens eye-pieces, but when we come to use eye-pieces composed of several lenses the matter becomes more difficult, and when we come to use those of a very high power the exact determination of the focal length of each lens becomes a matter of exceeding difficulty, and the result of such measurements cannot be relied on.

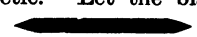
Another method, and one a good deal more to be depended on, is to have a circular disc of white paper on a black ground at a distance of 100 yards or so, and having a card with two black parallel lines drawn on it whose distance is exactly equal to the diameter of the paper circle, then viewing through the telescope the paper circle with one eye and the parallel lines on the card with the other let the lines be moved to such a distance from the eye that they shall exactly correspond with the diameter of the disc. The quotient found by dividing the distance of the paper disc from the eye by that of the parallel lines from the same gives the magnifying power of the telescope. This method, though good, requires some practice, and is only applicable to refractors

Digitized by Google

up to a certain size, and could not be used at all with Newtonian reflectors.

Another and much more convenient method consists in measuring the image of the object glass or speculum which a telescope forms in its solar focus. When we place our eye at a little distance from the eye-piece of a telescope we observe in the centre of the eye-lens a very distinct and well defined small disc of light. This is the image of the object glass or the speculum, as the case may be. Now if we can obtain a correct measure of the diameter of this disc, and also of the diameter of the speculum, by dividing the latter by the former, we have at once the number of diameters which the telescope magnifies.

For the purpose of accurately measuring this small disc of light as seen on the eye-lens, several kinds of "dynameters," or as some prefer to call them, "dynamometers," have been used. One of the latest, and perhaps the best, is that known as "Berthon's dynamometer." This consists of two strips of thin metal with straight edges so fastened together as to leave between them a long narrow triangular slit, one of the edges of which is so graduated and numbered that measures may be made with it down to one-thousandth of an inch.

While it is admitted that this measuring of the small disc is a very simple and direct method of obtaining the magnifying power, there are still several difficulties attending its application. For example, a very small disc of light is not the easiest thing to measure, besides it is not possible to measure a circular disc on its exact diameter by placing it between two lines which are not quite parallel, and Mr. Berthon has devised a very simple and efficient means by which these difficulties may be obviated, and here I would give Mr. Berthon's own description:—"Take or make a box twenty inches long and about six inches in its other dimensions, entirely open at one side. Make a hole in one end, and set it upon the other. Provide a card to fit the lower end inside; to the middle of this card attach a narrow slip of black paper (the border of mourning note paper will do), say four inches long. Then place the eye-piece to be measured in the hole, and use my V-dynamometer, and by dividing four inches by the ascertained length of the image of the black line, you have the power of the eye-piece on a focal length of twenty inches, whence its power on any other number of inches may be ascertained by simple arithmetic. Let the black slip or mark be pointed at each end, thus  and it is surprising how exactly its image can be measured, even to the five-thousandth of an inch. It is well to have three or four cards with lines of various but exactly measured lengths, say two, three, four, &c.,

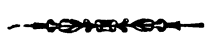
Digitized by Google

inches, and always to use the longest that the eye-hole will admit of."

I may say that to facilitate calculations I have made my box twenty-one inches in length, being just the sixth part of the focal length of my speculum, which is ten feet six inches.

I may also mention one or two things that should be observed in making use of this apparatus. In the first place the dynamometer should be laid as close on the eye-glass as possible, otherwise we cannot be certain that our measure is correct. Also we must measure our distance not from the card to the eye-lens, but should the eye-piece be a Huyghenian or negative eye-piece we must measure from the card to the diaphragm half way between the field-lens and the eye-lens, for this diaphragm is or ought to be at the exact focal distance of the instrument and where the image is formed. Should the eye-piece be a "Ramsden," or a positive eye-piece of any kind, of course the measure must be taken from the card to the point where the image is formed, just in front of the field-lens. These precautions being attended to a very exact measure of the magnifying power of any telescope may be obtained.

I might remark in conclusion that very many persons have an idea that in using a telescope, and especially if it be a refractor, that they are looking through the instrument, but the truth of the matter is that we cannot see through any telescope whether it be a refractor or a reflector, and we see not the object itself, but only a magnified image of that object, which image is formed in the focus of the eye-lens.



Digitized by Google

The Gastropods of the Older Tertiary of Australia. (Part II.)

By Professor Ralph Tate, F.G.S., F.L.S.

[Read October 2nd, 1888.]

Plates II.–X.

[SUPPLEMENT TO PART I.]

Fusus henicus, *spec. nov.* Plate vi., fig. 11.

Shell fusiform, with a short spire, ending in a turbinate pullus of one and a half smooth convex whorls.

Whorls, three, excluding the apical one, rather sharply keeled in the one-fourth, obliquely plicated; the plicæ (ten to a whorl) forming blunt wedge-shaped tubercles on the keel.

Surface ornamented with stout subangulated liræ, about seven on the last whorl posterior to the periphery, with occasionally a slender thread in the broader intervening sulci, and by coarse subdistant curvilinear growth-lines.

The last whorl abruptly contracted in a long straight, slender, open beak; base with numerous wrinkled liræ, the interspaces coarsely cancellated.

Dimensions.—Length, 25; breadth, 11·5; length of canal and aperture, 18.

Locality.—Lower beds at Muddy Creek (*J. Dennant*).

This species comes near to *F. Aldingensis*, from which it differs by its turbinate pullus, coarser ornament, blunt nodulations, and by the angulation of the whorls being closer to the anterior suture. It has also much resemblance to the young of *Tudicula turbinata*.

Fusus Gippslandicus, *Tate.* Figured herewith, Plate iii., fig. 6.

Fasciolaria fusilla, *spec. nov.* Plate vi., fig. 12.

Shell ovately fusiform, with a moderately long spire, ending in a prominent bead-like pullus with the apex laterally immersed. Whorls, four, excluding the pullus, flatly convex, spirally lirate, and distantly transversely lined; liræ slender, more or less alternately large and small, about 18 on the penultimate whorl, a little narrower than the intervening sulci.

Last whorl regularly rounded to the gradually contracting base, spirally lirate; columella slightly arcuate with three

Digitized by Google

strong oblique plaits, the anterior one of which at the junction with the snout, is the largest, and is somewhat decurrent on the relatively short, slightly bent, and open canal.

Dimensions.—Length, 42; breadth, 17; length of aperture and canal, 28.

Locality.—Lower beds at Muddy Creek (*J. Dennant*).

This species differs from all those previously described by its rounded whorls without costæ or tubercles, and has no analogue among recent forms.

Peristernia Murrayana, *Tate.* Figured herewith, Plate iv., fig. 4.

Peristernia pumila, *spec. nov.* Plate viii., fig. 4.

Shell fusiform, with a short subscalar spire, ending in a small mamillate apex of one and a half smooth convex whorls.

Whorls four (excluding apical one), a little flattened in front of the suture, with nine stout plications to each whorl; plicæ narrowly rounded, high, elevated into blunt tuberculations at the shoulder. Surface smooth, shining, ornamented with a few distant incised spiral lines.

Last whorl flatly rounded in the middle, where the plicæ fade away, thence abruptly contracted into a very short straight beak. Aperture oval-oblong; outer lip thin, smooth within; columella with three strong oblique folds; canal very short, open, straight, a little reverted at the tip.

Dimensions.—Length, 4·75; breadth, 2·25; length of aperture and canal, 2.

Locality.—Clayey green sands, Adelaide bore.

By its very short canal this species bears a general resemblance to *P. apicilirata* and *P. actinostephes*, from which it differs in its smooth pullus and tabulate whorls.

Eburnopsis, *gen. nov.*

It is with some diffidence that I establish a new genus for the reception of the following species, which has the general aspect of *Eburna;* but unlike all known species of that genus, it is spirally ribbed and wants the callous structure of the inner lip and umbilical region; moreover, the truncated columella, with its subtuberculated extremity, is unknown in *Eburna.* The generic name indicates its affinity with *Eburna.*

Euburnopsis aulaccessa, *spec. nov.* Plate iv., fig. 3.

Shell ovately globose, spire very short, ending in a moderately large globose pullus.

Ordinary whorls three, narrow, deeply channelled at the suture, the shoulder sharp-edged and strongly defined. Ornamented with moderately elevated, rounded spiral ribs (six on the penultimate whorl), a little narrower than the somewhat concave

Digitized by Google

furrows; the whole surface strongly and closely wrinkled transversely. Last whorl regularly and moderately convex from the middle to the base, spirally ribbed and sulcated; umbilicus narrow, defined by a rib a little broader than the rest of the ribs, which results from the successive infilling growths of the siphonal notch.

Aperture oval, channelled posteriorly, corresponding with the shoulder of the whorl; outer lip thin, crenulated on the edge, joined to the columella by a callous growth; columella slightly incurved, obliquely truncated and thickened at the front; siphonal notch shallow and narrow.

Dimensions.—Length, 14; breadth, 10; height of aperture, 10.

Locality.—Lower beds at Muddy Creek (*J. Dennant*).

Phos Gregsoni, *Tate.* Figured herewith, Plate iv., fig. 5.

Nassa sublirella, *Tate.* Figured herewith, Plate iv., fig. 2.

FAMILY VOLUTIDÆ.

Genus Lyria.

SYNOPSIS OF SPECIES.

Costæ, 20, terminating posteriorly in blunt points.
1. *L. harpularia.*

Costæ, 30, terminating posteriorly in small rounded tubercles.
2. *L. gemmata.*

Lyria harpularia, *Tate.*

Trans. Roy. Soc., S. Aust., 1888, t. 12, fig. 12, without description.

Shell fusiformly ovate, somewhat thin, transversely costate; costæ, about 20, on last whorl, narrow, subacute, slightly flexuous, terminating posteriorly in blunt points on the slightly flattened shoulder; interstices wider than the costæ, transversely and spirally striated. Spire subacute, of six slightly convex whorls terminating in a smooth pullus of one and a half whorls. Aperture elliptical-elongate, outer lip thin, united to the pillar by a thin callus; columella with two prominent anterior folds and numerous transverse rugosities; canal very short, recurved.

Dimensions.—Total length, 32; breadth, 17; length of aperture, 22; breadth, 8; height of last whorl, 26.

Localities.—Lower beds at Muddy Creek; blue clays at Schnapper Point.

Lyria gemmata, *spec. nov.* Plate iii., fig. 4.

Similar to *L. harpularia*, but usually narrower and less ventricose with about 30 slender, less flexuous, ribs on the last whorl,

Digitized by Google

which terminate posteriorly in small beadlike tubercles, and rendered more conspicuous by an ill-defined narrow encircling depression in front of the suture.

Dimensions.—Total length, 19; breadth, 9; length of aperture, 13.

Locality.—Upper beds at Muddy Creek (*J. Dennant*).

Genus Voluta.

Synopsis of species.

Nucleus spherical, disproportionately large, columella plaits 3 or 4.
- Outer lip expanded, wing-like; whorls tuberculated on the shoulder. 1. *V. Hannafordi.*
- Outer lip not expanded; whorls strongly costated.
  - Costæ, 7 on last whorl, roundly angled. 2. *V. heptagonalis.*
  - Costæ, 11 on last whorl, sharply angled. 3. *V. alticostata.*
  - Costæ, 14 on last whorl. 4. *V. Stephensi.*

Nucleus turbinated, crenulated; spire-whorls costated and bearing spinous scales at the shoulder; columella plaits, 4.
- Ribs on posterior whorls, about 20 pairs. 5. *V. McDonaldi.*
- Ribs on posterior whorls, about 9. 6. *V. uncifera.*

Nucleus papillary, smooth; outer lip winged.
- Spire nearly as long as aperture; nucleus small, with an erect tip. 7. *V. macroptera.*
- Spire nearly half length of aperture; nucleus large, blunt; whorls medially angulated. 8. *V. Mortoni.*

Nucleus papillary, smooth; outer lip not expanded.
- Shell sub-cylindrical; surface finely wrinkled spirally.
  - Last whorl with 14 inconspicuous transverse nodulations; suture concealed 9. *V. limbata.*
  - Last whorl with seven transverse tubercles; suture exposed. 10. *V. conoidea.*
- Shell oval-oblong to turriculate.
  - Surface of anterior whorls smooth, without tubercles.
    - Pullus mamillate, large, its apex laterally immersed. 11. *V. ancilloides.*
    - Pullus papillary, blunt; apex central.
      - Spire attenuate, whorls slightly convex, pullus small.
        - Posterior whorls smooth. 12. *V. McCoyii.*
        - Posterior whorls tuberculate. 13. *V. protorhysa.*
      - Spire short, whorls convex, pullus large. 14. *V. polita.*

Digitized by Google

Pullus subcylindrical, blunt; apex central.
Surface spirally striated or finely ridged, especially on posterior whorls.
15. *V. ellipsoidea*
Pullus acuminate, pointed at the end.
Spire half length of aperture; posterior whorls spirally lined. 16. *V. capitata.*
Spire less than one-third of the aperture, ornamented with transverse colour-lines.
17. *V. Masoni.*
Surface with spiral threads, at least on the posterior whorls.
Spiral lines on posterior whorls only; see 7, 11, 15, 16, 26.
Spiral ornament on all the spire whorls.
Outer lip varicosely thickened.
18. *V. crassilabrum.*
Faint longitudinal ridges on last whorl; pullus rather depressed.
19. *V. lintea.*
Whorls cancellated. 20. *V. cribrosa.*
Whorls costated; spire turreted.
21. *V. sarissa.*
Surface costulate or costate, without spiral ornament.
Costulæ not prominent; spire half the length of aperture. 22. *V. lirata.*
Costulæ conspicuous; spire about one-third length of aperture. 23. *V. costellifera.*
Costated; spire nearly as long as aperture.
24. *V. pseudolirata*
Surface tuberculated.
Spire elongated, at least one half the length of aperture; columella plaits, 4.
Last whorl tuberculated, but not costated.
Apex blunt; tubercles blunt, on anterior whorls only. 25. *V. cathedralis.*
Apex pointed; tubercles sharp on all the whorls; fine spiral striæ.
26. *V. pagodoides.*
Anterior of last whorl costated.
Tubercles blunt; aperture a little longer than spire. 27. *V. Tateana.*
Tubercles pointed; spire about the length of aperture. 28. *V. tabulata.*
Spire short, less than half the length of aperture.
A second row of tubercles at the suture; pullus small.

Digitized by Google

Costæ angular, ending in pointed tubercles. 29. *V. antiscalaris.*
Costæ rounded, with obtuse tubercular ends at the shoulder. 30. *V. anticingulata.*
Tubercles on shoulder of whorl only; pullus large.
Tubercles spinous; ante-sutural area concave. 31. *V. strophodon.*
Tubercles short, conical; whorls convex behind. 32. *V. Weldii.*

SPECIES UNCLASSIFIED.

V. Agnewi, *Johnston*, Proc. Roy. Soc. Tasmania for 1879, p. 37, non 1888; *V. antiscalaris*, Johnston, Geol. Tasmania, t. 30, f. 8, 1888. Table Cape.

V. Allporti, *Johnston*, op. cit. p. 35, 1880, non 1888. Table Cape.

V. pellita, *Johnston*, op. cit., p. 37, 1880; id. Geol. Tasm., t. 30, f. 2. Possibly *V. ancilloides* or *V. macroptera*. Table Cape.

V. stolida, *Johnston*, op. cit., p. 36, 1880; Geol. Tasmania, t. 30, figs. 4-4*a*. Related to *V. strophodon*. Table Cape.

1. Voluta Hannafordi, *McCoy*.

Reference.—Prodromus Pal. Victoria, Decade I., tab. vi., fig. 1, 1874; Decade IV., tab. 37, fig. 1.

Localities.—Older beds at Muddy Creek!; clays at Schnapper Point!; Port Fairy, Warrnambool; and at Fyan's Ford (*McCoy*).

This species is remarkable for its large pullus and winged outer-lip; the whorls are obtusely angled and nodosely-tuberculate; the posterior slope of the body whorl is spirally ridged or lined, the front is smooth.

Length, exceeding 150; breadth, 90; pullus, 12 in diameter.

The only other winged species are *V. macroptera*, McCoy, and *V. Mortoni*, Tate, which are smooth, or nearly so, with a small pullus.

2. Voluta heptagonalis, *spec. nov.* Plate iv., figs. 1 and 7.

Shell narrowly fusiform, with a moderately long scalar spire ending in a large spherical pullus of one and a half smooth whorls, the apex of which is laterally immersed; the pullus is partitioned off from the spire. Whorls, four, beside the pullus; the first one convex, spirally lined, and faintly plicate, at first very narrow, but enlarging and developing a shoulder and strong costæ on the next whorl; the two other spire-whorls angulated in the posterior-third, the area next to the suture being nearly flat or slightly

Digitized by Google

concave, the anterior portion nearly straight or parallel with the axis.

Surface ornamented with roundly angular axial ribs, which terminate in bluntly angled tubercles at the shoulder; shoulder broadly and deeply undulate between the tubercles. The ribs are seven in number on the body whorl, but increase to about eleven on the posterior whorls. The sculpture on the posterior spire-whorls consists of spiral lines crossed by transverse striæ; that on the body-whorl is not accurately known but is apparently limited to transverse lines of growth.

Body-whorl with the ribs strongly developed into thick conical tubercles at the shoulder, fading off to the front at about the middle; base gradually much attenuated. Aperture elongate-obovate; columella with three strong plications.

Dimensions.—Total length, 150; greatest breadth, 62; length of aperture, 95; greatest width, 28; diameter of pullus, 14; height, 13.

Locality.—Calciferous sandstone of the River Murray cliffs near Morgan.

3. Voluta alticostata, *spec. nov.* Plate v., fig. 7.

Shell resembling *V. heptagonalis*, but is proportionately shorter or broader. The ribs are sharply angled, eleven on the body-whorl, increasing to fourteen on the posterior whorls. The sculpture on the posterior whorls consists of crowded spiral lines rendered wavy by the crossing of striæ and growth lines; the same sculpturing is present on the posterior slope and shoulder of the body-whorl, but the rest of its surface is smooth; pullus and columella plaits as in *V. heptagonalis*. The pullus was hopelessly shattered by an accident before the execution of the drawing, but it revealed, in the unique specimen, a septum between it and the spire.

Dimensions.—Length, without pullus, 90; breadth, 49; length and breadth of aperture, 60 and 21.

Locality.—Lower beds at Muddy Creek (*J. Dennant*).

4. Voluta Stephensi, *Johnston.*

Reference.—Proc. Roy. Soc., Tasmania, for 1879, p. 35 (1880); id., Geology of Tasmania, t. 30, f. 1 (1888).

From an unpublished drawing furnished me by Mr. Johnston, this large species belongs to the same natural group as *V. heptagonalis* and *V. alticostata*, being intermediate in proportions between the two; it is further distinguished by having 14 ribs on the body whorl, increasing to 18 posteriorly, and by the absence or indistinctness of spiral sculpture.

Dimensions.—Length, 110; breadth, 55.

Locality.—Table Cape (*R. M. Johnston*).

Digitized by Google

The two following species may conveniently be included in the Section *Vespertilio*, though they present in their large turbinate pullus of several crenulated whorls a facies peculiarly their own.

5. Voluta MacDonaldi, *Tate*. Plate iii., fig. 5.

Reference.—Gastropods, Part I., plate xii., fig. 11 (1888).

Shell oval-oblong, with a rather short gradated spire ending in a subcylindrical pullus of four and a half narrow crenulated whorls, the terminal ones depressed.

Whorls three, excluding pullus; the two posterior whorls angulated in the posterior-third, the front parallel with the axis and costated, the posterior area concavely sloping upwards; the costæ terminate at the shoulder in high-vaulted spinous scales; on the first spire-whorl the spines are about 20 in number, and terminate each a pair of costæ.

The body whorl is somewhat ventricose, with a high shoulder, concavely sloping upwards to the suture; the angulation crowned with 16 spinous scales which terminate broad undulations, not ribs, rapidly becoming obsolete. Columella with four distant plaits; outer lip thin. The whole surface is sculptured with striæ and growth-lines; the only spiral-sculpture is confined to the last whorl of the pullus.

The pullus is not sharply separated from the ordinary spire-whorls, as there is a gradual change in the shape and ornament of the whorls; the actual junction being somewhat indicated by a slight eccentrictity of the first spire-whorls. Counting from the summit, the first and second whorls are smooth, flatly convex, with a deep suture, almost on a level, though the extreme tip is a little raised; the third whorl is convex, flatted, and strongly crenulated in front of the suture; the crenulations gradually elongate with the increasing angulation, so that the last is conspicuously angulated and costated, but not at all spinously produced; this last whorl is marked moreover with fine spiral ridges.

Dimensions.—Total length, 115; breadth, 67; length of aperture, 80; width, 130; height of pullus, 11; greatest width, 13·5.

Locality.—Lower beds at Muddy Creek (*H. McDonald*); blue clays at Schnapper Point (*R.T.*).

Until I received the very handsome specimen, herewith figured, from Mr. McDonald, of Hamilton, after whom I am pleased to name the species, I was acquainted with only two very young specimens collected by myself at Schnapper Point, one of which is figured in my Part I., as quoted above.

Digitized by Google

6. Voluta uncifera, *Tate.*

Reference.—Gastropods, Part I., plate xii., fig 10.

Two young examples only known, which exhibit the general character of equally sized specimens of *V. McDonaldi*, but the specific differences are—the whorls of the pullus are all convex and feebly tubercular ridged; the body whorl is more attenuated, and has only about nine spinous scales on the angulation which terminate less defined costæ.

Dimensions of an example of six and a half whorls, including the apical ones:—Length, 34; width, 20; length of aperture, 22; width of pullus, 10.

Locality.—Calciferous sandstone of the River Murray Cliffs, near Morgan (*R.T.*).

7. Voluta macroptera, *McCoy.*

Reference.—Proc. Pal. Victoria, Decade I., tab. viii., figs. 1—4 (1874).

This species is fusiform, attaining to a length of about 150 mills.; the spire is moderately elongate, and consists of flatly convex whorls terminated by a relatively small papillary pullus, the extreme tip of which is erect; the whorls are smooth, except the two posterior ones, which are spirally striated or lined. At the adult stage the outer lip becomes dilated into a very large thin-edged, triangular, flattened wing.

Localities.—Bird rock, Geelong (*McCoy; J. B. Wilson!*); calciferous sandstone of the River Murray Cliffs, near Morgan (*R. T.*); Table Cape (Hobart Mus. !).

8. Voluta Mortoni, *spec. nov.* Pl. ix., figs. 1 and 2.

Shell fusiform, with a short spire of subangular whorls terminating in a relatively large, smooth, blunt pullus, the top of which is laterally immersed.

Whorls three and a half, excluding the pullus, the first half turn of the spire almost concealed, thence the revolutions rapidly enlarge to the somewhat ventricose body-whorl. The outer lip of the body-whorl is dilated into a large, thin-edged, flattened wing; its outer margin broadly convex, its posterior margin slightly concave running up to the angulation of the penultimate whorl.

The two posterior whorls are microscopically striated between a few distant raised lines; otherwise the shell is marked only with fine lines of growth.

Columella with two plaits, almost concealed from view.

Dimensions of a nearly adult shell (fig. 1).—Total length, 65; breadth, 32; length of aperture, 44; diameter of pullus, 5.

Localities.—Lower beds at Muddy Creek (*J. Dennant*); Table Cape (Hobart Mus. !)

Digitized by Google

I know of only two specimens which I have figured. Fig. 1 represents a perfect shell just about to develop the wing; fig. 2 wants the pullus and the basal part of the body-whorl, the angular body-and spire-whorls of which are similar to those of the other specimen, and therefore I think it not unreasonable to view the two as individuals at different stages of growth of the same species.

This species is named in honour to Mr. Alexander Morton, of Hobart Museum.

V. Mortoni is evidently closely allied to *V. macroptera*, but it is distinguished from it by its shorter spire, different pullus, and angulated whorls.

9. Voluta limbata, *Tate.*

Reference.—Gastropods part I., plate xiii., fig. 8 (1888).

Shell oblong and sub-cylindrical, spirally and transversely striate; spire short, terminated by a rounded pullus; columella with four well-developed plaits, increasing in size from the base backwards. Sutures and spire-whorls concealed by the free horizontal foliaceous expansion of the posterior margin of the preceding whorls. Last whorl faintly angled at the periphery, which is also defined by about ten inconspicuous angular nodosites. The spire-whorls and posterior part of the last whorl sculptured with delicate wavy lamellæ crossed by transverse folds and striæ; the spiral ornament is the stronger, but on the anterior area of the body-whorl, the transverse lines and folds are alone conspicuous, as the spiral striæ are obsolete, or visible only by the aid of a magnifier.

Dimensions.—Length, 32·5; width, 15; length of aperture, 27·5.

Locality.—Blue clays at Schnapper Point (*R.T.*)

This species and the next belong to the Section *Voluto-conus*, uniquely represented by *V. coniformis* (Cox), inhabiting the north-west coast of Australia, from which they differ in the angulated periphery, more or less nodulose; and this species by the retroflexed posterior margin of the whorls.

10. Voluta conoidea, *Tate.*

Reference.—Gastropod's part I., plate xiii., fig. 9 (1888).

Shell coniform, with a short spire, ending in a moderately mamillate pullus of three and a half turns, the last half turn sometimes crenulated. The first and second spire-whorls almost wholly embraced; the penultimate whorl is broadly depressed near the middle line, and slightly varicose over the posterior suture; the last whorl is faintly angled at the periphery, which is also defined by seven transversely elongate nodosites, posterior to which is a slightly concavely depressed zone. Outer lip sharp, slightly inflected in the middle. Columella with four well-

Digitized by Google

developed plaits, and a small posterior one. Surface sculptured as in *V. limbata.*

Dimensions.—Length, 44 ; breadth 21 ; length of aperture, 35.

Locality.—Lower beds at Muddy Creek (*R.T.*)

11. Voluta ancilloides, *spec. nov.* Plate iii., fig. 7.

Shell fusiformly oval-oblong, with a moderately elevated spire of four slightly convex whorls ending in a rather large sub-globose pullus of one and a half turns, the extreme tip of which is sub-laterally immersed. Posterior whorls sculptured with spiral fine threads and striæ, and rather close-set slender striæ of growth.

Body-whorl hardly narrowed at the base. Aperture narrowly oblong, narrowed above, broad at the front; outer lip nearly parallel with the axis, slightly thickened ; pillar slightly incurved to the broad siphonal notch ; columella with three prominent, rather approximate, narrow, moderately oblique plaits.

Dimensions.—Length, 75; breadth, 28; length of aperture, 47; diameter of pullus, 8 ; height, 6.

Localities.—Calciferous sandstone, River Murray cliffs near Morgan (*R.T.*) ; lower beds at Muddy Creek (*R.T.*) ; blue clays at Schnapper Point (*R.T.*) ; Table Cape (*Hobart Mus.!*).

This species has the general appearance of the young *V. macroptera,* but the pullus is different, and the outer lip is not arcuate as in that shell.

12. Voluta McCoyii, *Tenison Woods.* Plate ii., fig. 2.

Reference.—Proc. Roy. Soc., Tasmania, for 1876, p. 95 (1877); *V. Agnewi,* Johnston, Geol., Tasm., t. 30, f. 9, 1888 (non 1880).

Shell lanceolate-ovate, thin; whorls smooth, shining, striate with growth lines, slightly convex, but not regularly so, being slightly ventricose at the anterior suture and a little depressed towards the posterior one. Pullus small, blunt, smooth, papillary; the tip central, depressed, but not immersed. Columella plaits, four, thin, elevated, the posterior one small; outer lip thin, but perceptibly thickened.

Dimensions.—Length, 40; breadth, 16; length of aperture, 25.

Localities.—Table Cape (*T. Woods*), common in the lower beds at Muddy Creek and in the blue clays at Schnapper Point (*R. T.*).

13. Voluta protorhysa, *spec. nov.* Plate ii., figs. 6*a*—*b*.

Shell narrowly lanceolate-ovate, thin, with a small, low, depressed, blunt pullus. Whorls six and a half excluding pullus; the three and a half posterior ones longitudinally costated ; the costæ on the first one and a half turns are slender, angular, and numerous ; on the next turn they are stouter, few, and tuberculately enlarged in the posterior-third ; and on the last half-turn

Digitized by Google

they finally fade away. The anterior whorls are flatly convex, smooth, but with striæ of growth.

Outer lip thin, columella with four oblique, thin, high plaits.

Dimensions.—Length, 39; breadth, 13; length of aperture 22.

Locality.—Clayey green sands, Adelaide bore.

This species has much affinity with *V. McCoyii*, but apart from the ornate apical whorls, it is distinguished by its narrower outline and flatter whorls.

14. Voluta polita, *spec. nov.* Plate ii., fig. 7.

Shell similar to *V. McCoyii*, smooth and highly polished, but it is proportionately broader, the whorls more convex, and the pullus is larger, though similar. The columella plaits are five, lamellar, very high, somewhat expanded, incrassated, and reflexed outwardly.

Dimensions.—Length, 29; breadth, 13·5; length of aperture, 19·5.

Locality.—Lower beds at Muddy Creek.

15. Voluta ellipsoidea, *Tate.*

Reference.—Gastropods, Part I., plate xiii., fig. 4. [Present description has reference to a larger and perfect specimen, which has been subsequently acquired.]

Shell narrow, fusiformly oval; spire elongate, pullus subcylindrical of three and a half smooth ivory-white whorls, separated by a deeply impressed suture; the tip is central, hardly rising above the level of the succeeding turn.

Whorls four, the first one much narrower than the preceding whorl, flat, the rest of the spire whorls very slightly convex, finely sculptured with spiral and transverse striæ.

Last whorl elongate and very little tumid, hardly attenuated at the base. Aperture narrowly oblong, roundly angled behind with a wide open canal, a little bent to the right and reverted at the front. Outer lip sharp, a little insinuate at the suture, nearly parallel to the axis, slightly incurved medially, patulous at the point. Inner lip slightly convex medially, a little twisted and bent back in front, with four stout distant oblique plaits.

Dimensions.—Length, 62; width, 23; length of aperture, 42; width, 7; height of pullus, 6; breadth, 6.

Locality.—Lower beds at Muddy Creek.

16. Voluta capitata, *spec. nov.* Plate ii., figs. 3*a*—*b*.

Shell fusiform-oval, thick, with a moderately long acuminate spire, ending in a smooth conic pullus of five turns, middle whorls of pullus much wider than the rest, the last whorl much narrowed, suture impressed; first two whorls channelled at the suture with an acute shoulder, the tip is exsert.

Digitized by Google

Whorls three, excluding the pullus, slightly convex and a little tumid medially; spirally lined and transversely striate, conspicuously so on the posterior whorl.

Last whorl elongated, a little tumid, hardly attenuated at the base. Aperture elongate-oval, angled behind, with a wide open canal a little bent to the right, and slightly reverted at the front. Outer lip thick within, but bevelled to a sharp edge, a little insinuated and slightly ascending at the suture, slightly ecurved medially, patulous at the point. Inner lip nearly straight, with four stout oblique plaits.

Dimensions.—Length, 61·5; breadth, 24; length of aperture, 43; width, 10; length of pullus, 6; width, 4·5.

Locality.—Well-sinking, Murray Desert.

This species has some affinity with *V. Pacifica* and other members of the section Alcithoe; but has not the outer lip proper to them; from *V. Pacifica*, which it resembles most in shape, it differs by its smooth flattish whorls.

17. Voluta Masoni, *spec. nov.* Plate iii., fig. 9.

Shell obconic, solid, smooth, polished; whitish, with transverse close-set, narrow, slightly undulose, chestnut lines. Last whorl roundly angled at the periphery; spire very short, acuminately conical, ending in a small, smooth, broadly conical pullus of four whorls. Columella with four well-developed plaits, and sometimes with an inconspicuous posterior one.

Dimensions.—Length, 58; width, 29; length of last whorl, 51; of aperture, 49.

Locality.—Upper beds at Muddy Creek.

This species belongs to the peculiarly Australian Section *Amoria*, amongst which it resembles *V. Turneri* and *V. undulata*, having the shape rather of the latter, and the coloration of the former; it is, however, distinguished from both by the abrupt peripheral inflation and the acuminate spire.

By the kindness of Mr. S. Mason, the proprietor of the land on which the chief fossiliferous deposits of Muddy Creek are found, I am in possession of the interesting volute which has served for the foregoing description. It is with much pleasure I associate Mr. Mason's name with his discovery, more particularly also because of his hospitality and assistance rendered to all visitors in search of fossils.

18. Voluta crassilabrum, *spec. nov.* Plate iii., fig. 2*a*—*c*.

Shell small, thick, oval; pullus small, of two smooth convex whorls.

Whorls three, excluding pullus, slightly convex excepting the penultimate, which is somewhat tumid; suture concealed by a narrow sutural band. Surface ornamented with close-set, narrow,

Digitized by Google

depressed, wavy threads, separated by linear interspaces (about 25 on penultimate whorl); a few indistinct undulations cross the whorls. Last whorl very slightly convex, a little attenuated and concavely depressed at the base, varicosely thickened behind the aperture. Aperture elongate-oval, narrowed at the ends; canal narrow, open, a little bent to the left and upturned at the front. Outer lip ascending a little at the suture, slightly arcuate, the edge blunt. Columella a little twisted at the front with four stout, oblique plaits, the second being the stoutest and the two posterior ones the smallest.

Dimensions.—Total length, 9; breadth, 4; length of aperture, 6.

Locality.—Lower beds at Muddy Creek.

19. Voluta lintea, *spec. nov.* Plate iii., figs. 1*a*—*b*.

Shell fusiform, narrow, thick; pullus of two and a half whorls, blunt and smooth at the top, the last half turn with slender costæ.

Whorls three and a half, rather flat, faintly depressed medially, with an impressed suture. Surface ornamented with numerous slender, wavy threads, a little narrower than the interspaces. Last whorl slightly convex, gradually attenuated to the moderately long straight canal; the posterior half with about eight angular ridges, which are faintly traceable from the suture to the base, but are more conspicuous at the periphery. Aperture elongate-oval; columella with four equi-distant and nearly equal plaits.

Dimensions.—Length, 26; breadth, 10·5; length of aperture, 17.

Locality.—Calciferous sandstones of the River Murray Cliffs, near Morgan.

20. Voluta cribrosa, *spec. nov.* Plate iii., fig. 8.

Shell fusiform, with a moderately long spire; pullus conical of two and a half whorls, ending in an erect tip; last half turn narrow, flat, but slightly angulated and flattened at the suture.

Whorls, three, slightly convex, more depressed behind than in front; ornamented with acute spiral threads (about 15 on the penultimate whorl), slightly crenulated, the interspaces about four times wider, crossed by curved, distant, slender, angular liræ. Columella with equal and equi-distant plaits.

Dimensions.—Length, 34; length of aperture, 20.

Locality.—Turritella-clays, Blanche Point, Aldinga Bay.

21. Voluta sarissa, *spec. nov.* Plate ii., figs. 1*a*—*b*.

Shell fusiformly turreted, moderately stout; pullus of three and a half to four whorls, conoidal-cylindric, smooth, the middle whorl the highest and widest, the tip is exsert.

Whorls six (excluding the pullus), flatly convex, ornamented

Digitized by Google

with spiral threads and angular costæ. The three posterior whorls are a little concavely depressed in the posterior-third; the rounded spiral threads (about twelve on the first whorl), which are about as wide as the interspaces, increase in number with the revolution of the spire. On the fourth and fifth whorls, adjacent to the anterior suture, the threads are reduced to striæ; and on the body-whorl the anterior half is smooth, or nearly so.

The costæ begin to appear on the front half of the second posterior-whorl, and on the three anterior whorls have attained to stoutish, wedge-shaped, slightly curved angular ridges, which are continued in subdued strength to the anterior suture, but do not reach the posterior one.

Last whorl with about nine transversely elongate costæ on the periphery, not much attenuated to the broadish open canal which is bent to the right and slightly reverted. Aperture elongate-oval, narrow; the outer lip straight medially (the last whorl being flattened between the anterior tubercle and the lip), hardly ascending but slightly insinuate at the suture, patulous at the front. Columella nearly straight to the slightly incurved tip; with five equi-distant plaits, the first and fifth of which are smaller than the others.

Dimensions.—Length, 77; breadth, 22; length of aperture, 49.

Localities.—Calciferous sandstone, River Murray cliffs, near Morgan; lower beds at Muddy Creek.

22. Voluta lirata, *Johnston.* Plate ii., fig. 4.

Reference.—Proc. Roy. Soc., Tasmania, for 1879, p. 37, 1880; *V. Allporti*, Johnston, Geol. Tasm., t. 30, fig. 10 (1888), non 1880.

Shell ovately fusiform, rather thin, smooth, shining. Pullus broadly conical, of four smooth, flattish whorls, with an impressed suture.

Whorls three and a half, excluding pullus, moderately convex at the anterior-third; ornamented with curved, slender, rather angular costæ, crowded on the posterior whorl; and sculptured transversely with very fine lines of growth.

Last whorl a little ventricose at the periphery (where the costulæ are only conspicuous), gradually tapering to the broadish front. Aperture elongate-oval, much longer than the spire; outer lip bevelled to a thin edge, a little emarginate and ascending at the suture, almost straight medially, patulous at the front; canal short, open, turned to the right, hardly reverted; columella arcuate towards the front, with four equi-distant, equal, oblique plaits.

Dimensions of largest example:—Length, 69; breadth, 27; length of aperture, 50; height of pullus, 5; breadth, 5·5.

Digitized by Google

Localities.—Table Cape (*R. M. Johnston*); lower beds at Muddy Creek.

Authentic specimens of this species I have not seen, but the shell which I have figured under the name agrees with the diagnosis and dimensions given of the type.

23. Voluta costellifera, *spec. nov.* Plate ii., fig. 8.

This species differs from *V. lirata* by its shorter spire, more ventricose body whorl, and stronger ribs.

Dimensions.—Length, 61; breadth, 29; length of aperture, 47.

Locality.—Lower beds at Muddy Creek.

24. Voluta pseudo-lirata, *Tate.*

Reference.—Gastropods, Part I., plate xiii., fig. 6.

Shell fusiformly cylindrical, rather thin. Pullus dome-shaped of two smooth whorls.

Whorls five, excluding the pullus, slightly convex or subangulated medially; posterior whorl ornamented with slender, angular, crowded costæ, which become fewer and stouter with the increasing revolution of the spire, there being 14 on the last whorl.

Last whorl hardly tapering to the broadish front; aperture elliptical, not much longer than the spire; outer lip thin, slightly curved medially, patulous at the front; canal short, broad, open, a little bent to the right and reverted. Columella nearly straight, with four oblique plaits, the anterior one the smallest.

Dimensions.—Length, 62; breadth, 19; length of aperture, 35; diameter of pullus, 5.

Localities.—Lower beds at Muddy Creek; blue clays at Schnapper Point.

This species has the general character of *V. lirata*, but differs in shape and in the well-developed costæ; being somewhat intermediate between that species and *V. sarissa.*, though differing from the latter by its pullus and the absence of spiral sculpture.

25. Voluta cathedralis, *Tate.*

Reference.—Gastropods, Part I., plate xiii., fig. 10.

Shell fusiformly cylindrical; pullus dome-shaped of two and a half smooth whorls. Whorls four and a half, excluding the pullus; the two posterior whorls nearly flat, spirally lined; the rest of the whorls very slightly convex and tuberculated in the middle line, the posterior slope spirally lined, the anterior slope smooth; there are about 10 small transverse wedge-shaped tubercles on the penultimate whorl.

Last whorl narrow-oblong, tubercles about seven, the last one-third plain; transversely striated all over and spirally striated next to the suture. Aperture elliptical; outer lip thin, nearly

Digitized by Google

straight medially, thence slightly expanding to the hardly contracted broad, short, open canal. Columella nearly straight, with four oblique slender plaits, the anterior one of which is the smallest.

Dimensions.—Length, 46·5; breadth, 14; aperture, 25·5.

Locality.—Lower beds at Muddy Creek.

This species is closely related to *V. pseudo-lirata*, but is distinguished by the spiral sculpture and the reduction of the costæ to tubercles.

26. Voluta pagodoides, *Tate.*

Reference.—Gastropods, part I., plate xiii., fig. 7.

Has the general form of *V. cathedralis*, but all the whorls, six, except the pullus, are medially sub-angulated and spinosely tuberculated on the keel; the apex is sub-acute of one and a half small, narrow-rounded whorls. The sculpture consists of fine, spiral, wavy striæ, which are somewhat obsolete on the middle of the last whorl. Body-whorl more attenuated towards the base, which is bent and reverted. Columella with four sub-equal, equidistant, rather slender plaits.

Dimensions.—Length, 51; breadth, 16; length of aperture, 28.

Localities.—Turritella-clays, Blanche Point, Aldinga; clayey-green-sands, Adelaide bore; Turritella-grits, Ardrossan.

27. Voluta Tateana, *Johnston.* Plate ii, fig. 5.

Reference.—Proc. Royal Society Tasmania for 1879, p. 37 (1880); id. Geology Tasmania, t. 30, figs 3—3a.

Shell broadly lanceolate, fusiform, with a moderate high acute spire, ending in a small sharp pullus of two smooth turns. Whorls six, with regular sigmoid ribs which become somewhat obsolete towards the posterior suture, and towards the base of the body-whorl, but are raised into distinctly angled tubercles on the anterior-third of the whorl (12 on the last whorl); outer lip simple; columella nearly straight, with four stout oblique plaits.

Dimensions.—Length, 70; breadth, 20; length of aperture, 40.

Locality.—Table Cape (*R. M. Johnston !*).

This species closely resembles *V. Kreuslerœ*, Angas, of South Australian waters, but the spire is more acute.

28. Voluta tabulata, *Tate.*

Reference.—Gastropods, Part I., plate xiii., fig. 3.

Shell fusiform, with a rather short spire, ending in a moderately large pullus of two and a half whorls, the last half whorl costulate.

Whorls three and a half to four, excluding pullus, angulated ante-medially, costated in front of the keel, and sharply tuber-

Digitized by Google

culated on the angulation. The sculpture consists only of fine growth lines.

Last whorl with ten curved, angular, or broadly angular ribs, which are raised into sharp pointed tubercles on the keel; costæ becoming obsolete towards the base; base somewhat narrowly and abruptly contracted behind the very broad, short canal. Outer lip with a blunt margin, slightly emarginate behind, and ascending to the keel of the penultimate whorl. Columella nearly straight medially, ecurved at the extremity with four stoutish, equi-distant plaits.

Dimensions.—Length, 36; breadth, 17; length ot aperture, 26; diameter of pullus, 2·5.

Locality.—Well-sinking, Murray Desert.

29. Voluta antiscalaris, *McCoy.*

Reference.—Prod. Pal. of Victoria, Dec. 1, tab. 6, fig. 5, 1874.

Shell ovately fusiform, with a short or moderately long spire; pullus small, swollen of one and a half turns.

Spire whorls angularly convex, with a row of tubercles in front of suture and a second on the angulation; the latter terminate angular ribs; the two rows are separated by a rather wide concave space.

Last whorl with a variable number, about 15, of angular, slightly sigmoid ribs, extending less than half way to the base, each ending in a sharp conical tubercle on the angulation; there is a second smaller row at the suture, separated by a concave space.

Outer lip thickened at the edge and crenulated towards the front. Columella with about five plaits, the first and fifth small; sometimes a sixth plait is interposed.

The species shows some variation in the length of the spire; the short-spired variety has a more ventricose body-whorl; also in the spiral sculpture, being in some individuals obsolete, except at the base of the body-whorl.

Dimensions of a moderate-sized specimen.—Length, 39; breadth, 18·5; length of aperture, 29.

Localities.—Fyans Ford; Schnapper Point! (*McCoy*); lower beds at Muddy Creek; calciferous sandstones, River Murray cliffs.

This species closely resembles *V. scalaris*, Sow., from the Middle Eocene of Hampshire, but is especially distinguished by its obtuse, not acute, pullus.

30. Voluta anti-cingulata, *McCoy.*

Reference.—Prod. Pal. of Victoria; Dec. 1, tab. 6, figs. 2-4.

Synonym:—*V. antiscalaris*, Johnston, Geol. Tasmania, t. 30, figs. 5-5*b*.

Digitized by Google

This species has the general character of *V. antiscalaris*, with rather more ventricose whorls, the costæ end with obtuse tubercular ends separated from a row of conoidal tubercles at the suture by a deep, narrow, spiral constriction.

Dimensions.—Length, 50; breadth, 22; length of aperture, 39.

Localities.—Bird Rock (*McCoy*), and Spring Creek, near Geelong (*J. B. Wilson!*); well-sinking, Murray Desert; Table Cape (*R. M. Johnston!*).

This species stands in the same relation to the European *V. cingulata* as *V. antiscalaris* does to *V. scalaris*.

31. Voluta strophodon, *McCoy*.

References.—Prod. Pal. Victoria, Decade iv., tab. 37, figs. 2-4 (1876). *V. Weldii* (pars.), Johnston, Geol. Tasm., t. 30, fig. 7 (1888).

Shell varying from ovate with a moderate spire to conoidal with a very short spire; pullus large hemispheric to sub-cylindrical of four smooth slightly convex whorls. Ordinary whorls, with a row of spines crowning the shoulder, which is medial in the long-spired form, and at the suture in the conoidal variety; the area behind the tubercles smooth and concave; the spines on the body-whorl terminate ribs, which become obsolete at about half way to the front. Columella with four very large thick plaits, and often with a blunt protuberance posteriorly.

Dimensions of the long-spired form.—Length, 40; breadth, 20; length of aperture, 31; of the conoidal variety: length, 38; width inside spines, 23·5; length of aperture, 32·5.

Localities.—Fyans Ford, Moolap, Schnapper Point!, and lower beds at Muddy Creek! (*McCoy*); calciferous sandstones, River Murray cliffs, near Morgan!; well-sinkings, Murray Desert; Table Cape (*R. M. Johnston*).

If the extreme forms delineated by McCoy, figs. 2 and 4, *op. cit.*, belong to the same species, with which view I am inclined to concur, then *V. strophodon* is a more variable species than *V. antiscalaris*, both of which are exceptional in the genus. As pointed out by McCoy, the ordinary form of *V. strophodon* presents some resemblance to *V. spinosa*, Lamk.; but the resemblance of the conoidal variety to *V. athleta*, Solander, is even greater. These two species of the European Eocene are readily distinguished by the small conical pullus and by the one or two prominent columella-folds succeeded by two or three indistinct ones.

32. Voluta Weldii, *Tenison Woods*.

Reference.—Proc. Roy. Soc., Tasmania, for 1875, p. 24, tab. 1, fig. 2 (1875); Johnston, Geol. Tasm., t. 30, figs. 6—6*b* (non 7), 1888.

Digitized by Google

This species is closely related to *V. strophodon*, but the whorls are convex, without costæ, with sharp-edged tubercles at the angle. Tenison Woods compares it to *V. depressa*, Lamk., from which it differs by the same characters which separate the Australian species from their European analogues.

Dimensions.—Length, 46 ; breadth, 22.

Localities.—Table Cape (Hobart Mus. !) ; lower beds at Muddy Creek ; River Murray Cliffs near Morgan.

Genus Mitra.

synopsis of species.

Shell mitriform, striate or spirally grooved. [Eu-Mitra.]
- Spirally grooved and punctured.
  - Spire elongated ; grooves, 6 ; plaits, 5. 1. *M. alokiza.*
  - Spire conically fusiform ; plaits, 4. 2. *M. Dennanti.*
- Finely longitudinally striate, and more or less reticulate.
  - Spire elongated, narrow ; 1 large, 2 small plaits. 3. *M. dictya.*
  - Shell broader ; 1 columella plait. 4. *M. uniplica.*
  - Fusiformly-conic ; body whorl varicosely thickened ; 4 plaits. 5. *M. varicosa.*

Shell somewhat columbelliform, smooth. [Strigatella.]
- Shell broad ; outer lip crenate ; 4 plaits. 6. *M. atypha.*
- Shell narrower ; outer lip smooth ; 4 plaits. 7. *M. complanata.*
- An ante-sutural rib ; outer lip lirate ; 5 plaits. 8. *M. ligata.*

Shell fusiform, spirally ridged and transversely striate. [Cancilla.]
- Aperture two-thirds the total length of shell, pullus small. 9. *M. othone.*
- Aperture nearly one-half ; pullus large. 10. *M. atractoides.*

Shell fusiform, spirally and transversely ribbed ; aperture with a callosity at the posterior angle. [Zierliana.] 11. *M. escharoides.*

Shell fusiform, costated, abruptly contracted to a beak. [Costellaria.]
- Whorls convex or flat.
  - Spiral threads many. 12. *M. leptalea.*
  - Spiral ribs few, granulose ; spire somewhat scalar. 13. *M. euglypha.*
  - No spiral ornament. 14. *M. exilis.*

Digitized by Google

Whorls subangulated medially, without spiral ornament.
15. *M. paucicostata.*

Shell fusiform, costated, gradually attenuated to a beak.
Shell large, ribs curved; an ante-sutural thread.
16. *M. terebræformis.*
Shell small, with clathrate ornament. 17. *M. clathurella.*

Shell fusiform, spirally ridged; posterior whorls costate or plicate.
Whorls with slender plicæ.
Shell narrow, whorls regularly convex.
18. *M. biornata.*
Shell broader, whorls flatted and crenulate at suture.
19. *M. subcrenularis.*
Whorls with stout subtuberculose costæ.
20. *M. citharelloides.*

Shell fusiform, smooth or striated, not spirally ridged; posterior whorls costate. [Pusio.]
Shell ovate, costæ thick. 21. *M. sordida.*
Shell narrow, costæ angular. 22. *M. semilævis.*

Shell conoidal.
Spire short and broad, last whorl subangulated and tuberculose-costate. 23. *M. cassida.*
Spire narrower, last whorl rounded and spirally lirate.
24. *M. conoidalis.*

SPECIES UNFIGURED AND UNCLASSED.

Mitra anticoronata, *R. M. Johnston*, Proc. Roy. Soc. Tasmania for 1879 [1880], p. 34.

SPURIOUS SPECIES.

Mitra daphnelloides, *T. Woods*, is transferred to *Pleurotomidæ*.

Mitra coarctata, *T. Woods*, represents an immature example of *Marginella Winteri*, Tate.

Thala marginata, *T. Woods*, is transferred to *Pleurotomidæ*.

1. **Mitra alokiza,** *Tenison Woods.* Plate iv., fig. 8.

Reference.—Proc. Lin. Soc., N.S. Wales, t. 3, fig. 7, p. 8, 1879.

Shell rather thin, shining, narrowly fusiform; spire longer than the aperture, ending in a pullus of two small, narrow, rounded whorls. Whorls nine, excluding the apical ones, nearly flat, suture conspicuously margined anteriorly; regularly and distantly spirally grooved; grooves elegantly and closely punctated; first and second whorls slenderly costated. There are about seven very narrow grooves on the penultimate whorl, whilst a very slender one is interposed between the posterior one and the suture.

Last whorl subangulated in an alignment with the posterior

Digitized by Google

angle of the aperture, thence gradually attenuated; spirally grooved throughout.

Aperture narrowly elliptic; lip sharp; columella with five plaits, increasing in size from the front.

Dimensions.—Length, 55·5; breadth, 13; height of last whorl, 26·5.

Locality.—Lower beds at Muddy Creek.

The species was established on juvenile examples, which I have traced up to the moderately large specimen herein figured. The figure of the type does not correctly represent the shape, being much too broad.

2. Mitra Dennanti, *spec. nov.* Plate iii., fig. 3.

Shell moderately stout, fusiform-biconic; spire short, ending in a blunt apiculate point; pullus of four whorls, the anterior one large, much embracing the next, the last turn very small subglobose.

Ordinary whorls four, convex, separated by a narrow shallow channelled suture, with a rounded appressed shoulder, regularly spirally grooved; about twelve grooves on the penultimate whorl, crossed by close-set striæ, which produce the appearance of linear oblong punctures in the grooves.

Last whorl somewhat ventricose, the median portion smooth or spirally striated; posteriorly and anteriorly spirally grooved, and neatly punctated.

Aperture elongate-oval, outer lip thin; columella with four plaits, the posterior one the largest.

Dimensions.—Length, 33; breadth, 16; length of aperture, 22. The corresponding measures of a very large specimen are 47, 20, and 30.

Locality.—Lower beds at Muddy Creek (*J. Dennant*).

3. Mitra dictua, *Tenison Woods.* Plate iv., fig. 9.

Reference.—Proc. Lin. Soc., N.S. Wales, plate iii., fig. 7, p. 8, 1879.

Shell rather thin, elongate-fusiform; spire longer than the aperture, ending in a conoid pullus of three smooth, slightly convex, regularly increasing turns.

Whorls eight, excluding the pullus, nearly flat, separated by a linear impressed suture, the anterior ones by a narrow channelled suture with a rounded shoulder. The first and second have thick costæ and spiral linear grooves, the next three are spirally grooved and obscurely punctated, the whole surface crossed by raised curved threads; thence the spiral grooves gradually merge into threads or striæ.

Last whorl with a few slender striæ at the shoulder, spirally

Digitized by Google

ridged at the base, medially with conspicuous transverse sigmoid striæ; somewhat abruptly attenuated below the middle line.

Aperture ovate, outer lip thin; columella with two inconspicuous anterior plaits, and a large posterior one.

Dimensions.—Length, 40; breadth, 13; length of aperture, 20.

Localities.—Lower beds at Muddy Creek; and in well sinking, Murray Desert; Table Cape!

The figured example of which the dimensions are given is from the Murray Desert; in size it very much exceeds the type specimen from Muddy Creek, which is an immature shell, and whilst the representation of it gives the right proportions, yet it does not show the slight flattening at the suture; intermediate examples occur at the latter locality.

4. Mitra uniplica, *spec. nov.* Plate iv., fig. 12.

Differs from the foregoing by its more convex whorls more shouldered at the suture, wider body-whorl, which is less attenuated anteriorly, and by its single columella plait.

Dimensions of specimen, wanting posterior part of spire, of five whorls; length, 49; width, 17; length of aperture, 26.

Locality.—Blue clays at Schnapper Point.

5. Mitra varicosa, *spec. nov.* Plate v., fig. 1.

Shell stout, fusiformly conic, of seven whorls, ending in a small papillary pullus. Ordinary whorls slightly convex, a little ventricose behind anterior suture, and inconspicuously depressed in the posterior-third; transversely closely wrinkled and striate, crossed by fine distant equal liræ, about 12 on the penultimate whorl.

Last whorl varicosely dilated at the commencement and at about the middle; columella with four strong plaits, and two on the posterior part of the aperture.

Dimensions.—Length, 24; widtb, 10; length of aperture, 13.

Locality.—Clayey-green-sands, Adelaide bore.

6. Mitra atypha, *spec. nov.* Plate iv, fig. 6.

Shell stout, narrow-ovate, blunt at each end; whorls six, smooth, slightly convex. Aperture oval, outer lip lirate within, columella with four approximate plaits.

Dimensions.—Length, 10; breadth, 4·5; length of aperture, 5.5.

Locality.—Upper beds at Muddy Creek.

7. Mitra complanata, *spec. nov.* Plate v., fig. 12.

Shell rather thin, elongate-ovate, with a blunt apex, and rather attenuated at the front; whorls six, smooth, shining, slightly convex. Aperture narrow-elliptical; outer lip sharp, smooth within; columella with four distant plaits.

Digitized by Google

Dimensions.—Length, 8; breadth, 3·5; length of aperture, 5.
Locality.—Clayey-green-sands, Adelaide bore.

8. Mitra ligata, *spec. nov.* Plate v., fig. 4.

Shell rather thin, elongate-ovate, attenuated at each end; whorls seven, smooth, shining, very slightly convex, perceptibly constricted in front of the anterior suture, giving rise to the appearance of a spiral rib margining the suture. Aperture narrow-elliptical; outer lip sharp, lirate within; columella with five plaits.

Dimensions.—Length, 7; breadth, 3; length of aperture, 4.
Localities.—Lower beds at Muddy Creek; blue clays at Schnapper Point.

9. Mitra othone, *Tenison Woods.* Plate iv., fig. 10.

Reference.—Proc. Lin. Soc., N. S. Wales.

A small biconic shell, pointed at both ends, apex blunt of two and a half smooth whorls. Ordinary whorls separated by an impressed suture, sculptured with spiral threads which are more or less granulose, especially on the posterior part of spire, by transverse liræ or slender costæ. Last whorl lirate and transversely striate; columella with four well-developed plaits.

Dimensions.—Length, 12; breadth, 5; length of aperture, 8.
Locality.—Lower beds at Muddy Creek.

10. Mitra atractoides, *spec. nov.* Plate iv., fig. 11.

Shell narrowly fusiform-biconic, with a moderately elevated spire, ending in a blunt conoidal pullus of four smooth turns. Whorls five, excluding pullus, slightly convex, with a linear suture, sculptured with raised spiral threads and tessellated by curved transverse threads. Last whorl, with cancellate ornament, a little ventricose in front of suture, medially attenuated, but slightly dilated at the front.

Aperture very narrow; outer lip thin, smooth within, medially ecurved; columella nearly straight, with four plaits, the anterior one small.

Dimensions.—Length, 21; breadth, 7; length of aperture, 12.
Locality.—Lower beds at Muddy Creek.

This species has a resemblance to *M. othone*, but differs by its long spire, sub-cylindric pullus, and by certain details of its ornamentation.

11. Mitra escharoides, *spec. noa*, Plate v., figs. 8a—*b*.

Shell stout, narrow-fusiform, ending in a sub-cylindric pullus of two smooth whorls. Whorls six, excluding pullus, slightly convex; sculptured with broad, flat, transverse ribs, and by narrower spiral ones, which include between them large, roundly ob-

Digitized by Google

long depressions; there are eight rows of punctures on the penultimate whorl.

Last whorl a little sloping to the suture, but slightly attenuated to the bent and reverted short beak. Aperture narrow, oval-oblong, with a spiral callosity at the posterior angle; outer lip thin, slightly ecurved medially, stoutly lirate within; columella with four thick approximate plaits, increasing in size from the front.

Dimensions.—Length, 17; width, 5; length of aperture, 8.

Locality.—Lower beds at Muddy Creek.

12. Mitra leptalea, *spec. nov.* Plate v., fig. 3.

Shell turriculate, ending in a large sub-globose pullus with the tip laterally immersed. Whorls seven, excluding pullus, nearly flat, suture impressed; ornamented with numerous straight, slender, sub-acute transverse ribs closely and neatly striate in between, and crossed by fine, somewhat inequi-distant and unequal spiral threads (about 15 on penultimate whorls). Last whorl ovate-oblong; abruptly attenuated to a long beak, which is encircled by thick ribs, the posterior one subgranose. The posterior half of the whorl is slenderly costated and spirally lined, and is bounded anteriorly by a narrow belt devoid of spiral threads, and defined above and below by a slight angulation.

Aperture narrow-ovate, prolonged into a long beak, a little effuse anteriorly and slightly reverted; outer lip thin, smooth within; columella with four plaits.

Dimensions.—Length, 16; breadth, 5; length of aperture, 7.

Locality.—Lower beds at Muddy Creek.

13. Mitra euglypha, *spec. nov.* Plate v., fig. 13.

Shell broadly turriculate, ending in a subcylindric pullus of two and a half smooth turns. Whorls six, excluding pullus, convex, slightly depressed over the posterior suture; ornamented with numerous thick transverse ribs, which are crossed by stout spiral threads, about six on penultimate whorl, producing nodulations more or less distinct on the costæ.

Last whorl oblong-ovate, abruptly attenuated to a short stout beak, ornamented with slightly sigmoid costæ, which are more or less nodulated by the intersection of broader spiral liræ.

Aperture oblong-ovate, obtusely-angular behind; outer lip thin, lirate within; columella with four stout approximate plaits,

Dimensions.—Length, 15; breadth, 5·5; length of aperture, 7.

Locality.—Gippsland (*W. H. Gregson!*).

14. Mitra exilis, *spec. nov.* Plate viii., fig. 5.

Shell small, slender, turriculate, ending in a relatively large mamillate pullus of two smooth turns. The other whorls four, convex, with a very narrow oblique slope to the posterior suture,

Digitized by Google

the shoulder defined by a thick spiral rib, ornamented by very thick, angularly rounded, straight ribs (about 15 on the penultimate whorl), separated by very much narrower interspaces. Aperture oval-oblong, squarely rounded behind, abruptly contracted to a somewhat short and slender beak. Outer lip thin, smooth within; columella with three or four plaits.

Dimensions.—Length, 5·5; breadth, 1·75; length of aperture, 2.

Locality.—Lower beds at Muddy Creek.

15. Mitra paucicostata, *spec. nov.* Plate v., fig. 2.

Shell turriculate, ending in a relatively large pullus of two smooth convex turns, the top laterally immersed.

Whorls four and a half, excluding pullus, medially subangulated, ornamented with slightly bent angular costæ, which are subtuberculated on the spiral keel and at each suture (15 on penultimate whorl); interspaces faintly striated transversely.

Last whorl oblong, abruptly attenuated to a short, broad, reverted beak, which is spirally ridged; flatly rounded at the suture, ornamented with acute costæ, a slightly tuberculate antesutural keel, and two approximate tubercular ridges in an alignment with posterior angle of the aperture. Outer lip thin, roundly insinuated at the suture; internally lirate; columella with four stout approximate plaits.

Dimensions.—Length, 8·5; breadth, 4·5; length of aperture, 4.

Localities.—Lower beds at Muddy Creek; blue clays at Schnapper Point.

16. Mitra terebræformis, *spec. nov.* Plate v., fig. 5.

Shell fusiformly elongate, smooth, shining, ending in a stout high pullus of two turns, the first very small. Whorls six and a half, excluding pullus, nearly flat, ornamented by much curved angular plications, separated by very much broader shallow depressions; the posterior suture margined by a narrow band, defined by a thread-like keel.

Last whorl gradually attenuated into a short, broad, upturned beak, the curved costæ becoming obsolete in front of the middle line; the beak is spirally ridged.

Aperture ovate, angular behind; outer lip thin, smooth within; columella with four approximate plaits.

Dimensions.—Length, 16; breadth, 5; length of aperture, 7.

Locality.—Upper beds at Muddy Creek.

The shape, the curved costæ, and the antesutural band recall some of the leading characteristics of *Terebra*, and separate this species from all others of the genus, recent and fossil.

Digitized by Google

17. Mitra clathurella, *spec. nov.* Plate viii., fig. 8.

Shell small, fusiformly ovate, with a short obtuse pullus. Whorls four, excluding pullus, convex, margined and concavely depressed at the posterior suture; ornamented with rather slender oblique costæ (about 20 on the penultimate whorl), fine transverse striæ, and spiral threads, anterior to the antesutural depression (six on the penultimate whorl).

Last whorl with slender costæ, tessellated by spiral threads, the inter-depressions finely transversely striate.

Aperture narrow-oblong, contracted in front to a short broadish, bent, and slightly reverted beak. Outer lip slightly ascending on the penultimate whorl, slightly emarginate at the suture, smooth within; columella with four rather distant transverse plaits.

Dimensions. — Length, 6; breadth, 2·75; length of aperture, 4.

Locality.—Lower beds at Muddy Creek.

This species has much the aspect of a *Clathurella.*

18. Mitra biornata, *spec. nov.* Plate v., fig. 10.

Shell rather thin, narrow-fusiform, ending in a blunt pullus of one and a half smooth turns. Whorls, five, excluding pullus, convex, separated by an impressed suture; sculptured with slender, flat, spiral threads, and transversely finely striated, the three posterior whorls transversely plicate; there are about 18 spiral threads on the penultimate whorl.

Aperture narrow-oval, contracted into a short wide beak; outer lip thin, crenately wrinkled at the front, lirate within; columella with five plaits, the two posterior and larger ones biplicate.

Dimensions.—Length, 10·5; breadth, 3·5; length of aperture, 5.

Locality.—Lower beds at Muddy Creek.

19. Mitra subcrenularis, *spec. nov.* Plate v., fig. 6.

Shell rather thin, broadly fusiform, ending in a blunt papillary pullus of two and a half smooth turns. Whorls, five, excluding pullus, nearly flat, and slightly flattened at the anterior suture; sculptured with linear spiral grooves, and on the posterior whorls with transverse plications, which end posteriorly in granular crenatures.

Last whorl somewhat ventricose behind, spirally lirate, but the costæ are obsolete, or reduced to mere crenulations at the suture. Base rapidly attenuated in a short narrow beak. Outer lip thin, smooth within; columella with four distant plaits.

Dimensions.—Length, 11; breadth, 4·5; length of aperture, 6.5.

Locality.—Clayey-green-sands, Adelaide bore.

Digitized by Google

20. Mitra citharelloides, *spec. nov.* Plate v., fig. 11.

Shell narrow, ovately fusiform, ending in a moderately wide and large pullus of two convex turns. Ordinary whorls four and a half, convex, more sloping to, and slightly depressed at, the posterior suture; sculptured with fine, close spiral threads, about 20 on penultimate whorl, and ornamented with broad, rounded costæ, which end subtuberculosely at the posterior-third (ten on the penultimate whorl).

Last whorl gradually attenuated to the short, slightly reverted beak, spirally lirate throughout, and wrinkled transversely, the costæ entirely absent, or with one or two obsolete ones at the hinder part. Aperture narrow-oval; outer lip smooth within; columella with two slender plaits, situated at about the middle.

Dimensions.—Length, 9·5; breadth, 3·5; length of aperture, 5.

Localities.—Turritella-marls, Blanche Point, Aldinga Bay; clayey-green-sands, Adelaide bore.

This species has much the aspect of some species of *Cithara*, but there is no trace of a sutural notch.

21. Mitra sordida, *spec. nov.* Plate vi., fig. 6.

Shell small, stout, oval-oblong, blunt at both ends; whorls five, convex, smooth, ornamented with thick curved costæ (ten on penultimate whorl). Last whorl oblong, hardly attenuated at the front; the posterior-half with five costæ, the anterior-half smooth; base spirally striate.

Aperture narrow-oval; outer lip thin, much arched, slightly insinuate at the suture; stoutly lirate within; columella with four stout plaits.

Dimensions.—Length, 6·5; breadth, 3; length of aperture, 4.

Locality.—Upper and lower beds at Muddy Creek.

22. Mitra semilævis, *spec. nov.* Plate v., fig. 9.

Shell minute, narrowly oval-oblong, with a large, blunt apex. Ordinary whorls three, slightly convex, a little margined at the anterior suture, ornamented with curved sub-angular costæ, which are thicker at the anterior suture, and a few spiral striæ posteriorly; there are twelve costæ on the posterior whorl.

Last whorl attenuated into a longish, slightly reverted beak; faintly spirally striate next the suture, transversely wrinkled in the posterior half-turn. Aperture narrow oval; outer lip lirate within; columella with four stout plaits, which are continued as spiral ridges around the beak.

Dimensions.—Length, 5·5; breadth, 2; length of aperture, 3.

Localities.—Lower beds at Muddy Creek; blue clays at Schnapper Point.

Digitized by Google

23. Mitra cassida, *spec. nov.* Plate vi., fig. 5.

Shell small, stout, biconic, with a very short, somewhat acuminate spire, ending in a relatively large papillary pullus. Ordinary spire whorls convex, ornamented with slender costæ.

Last whorl ventricose posteriorly, abruptly sloping to the suture, and rapidly attenuated to the front; the shoulder of the whorl ornamented with transverse sub-tuberculose ridges.

Aperture narrow-elliptic; outer lip thin, smooth; columella with four plaits.

Dimensions.—Length, 7; breadth, 4; length of aperture, 5·5.

Locality.—Upper beds at Muddy Creek.

24. Mitra conoidalis, *spec. nov.* Plate x., figs. 2*a*—*b*.

Shell small, stout, biconic, with a short regularly conic spire, ending in a relatively large depressed pullus; ordinary spire whorls nearly flat, sloping more rapidly to the anterior suture, and slightly margined at the posterior suture; ornamented by slender costæ and a few spiral engraved lines.

Last whorl oblong, rather abruptly attenuated at the base, flatly rounded over the suture; with a few revolving threads at the shoulder and at the base, the median portion transversely striate.

Aperture narrow-elliptic; outer lip thin, smooth; columella with four plaits.

Dimensions.—Length, 7; breadth, 3·5; length of aperture, 5·5.

Locality.—Lower beds at Muddy Creek.

FAMILY OLIVIDÆ.

Genus Oliva.

It is not possible to separate conchologically *Olivella* from *Oliva*, as the only difference between them is the longer or shorter spire, which is by no means an absolute measure, though it is not improbable that the following species may belong to the former genus.

SYNOPSIS OF SPECIES.

Length more than three times the breadth.	1. *O. angustata.*
Length less than three times the breadth.	
Shell narrower; spire longer.	2. *O. Adelaidæ.*
Shell wider; spire shorter.	3. *O. nymphalis.*

1. Oliva angustata, *spec. nov.* Plate viii., figs. 7*a*—*b*.

Shell narrowly elongate-ovate, shining; spire acuminate, of six whorls; suture excavated; aperture narrow, longer than the spire; columella twisted with five or six anterior spiral grooves.

Dimensions.—Length, 18·5; breadth, 5·5; length of aperture,

Digitized by Google

11·5; breadth of aperture at front, 2. Imperfect specimens have a length of 25 mills.

Locality.—Lower beds at Muddy Creek.

A very much more slender shell, with a longer spire, than *O. australis*, Duclos.

2. **Oliva Adelaidæ**, *spec. nov.* Plate viii., fig. 6.

Shell elongate-ovate, shining; spire bluntly acuminate, of four whorls, channelled at the suture; aperture longer than the spire; outer lip slightly arched, truncate at the base; columella slightly twisted and plicate anteriorly.

Dimensions. — Length, 10.5; breadth, 4; length of aperture, 6.

Locality.—Clayey-green sands, Adelaide-bore.

This fossil has the general appearance of *O. pardalis* and *O. leucozona*, of New South Wales, but it is proportionately stouter, the apex is blunt, and the aperture is longer and narrower at the front. The relative dimensions respectively of *O. Adelaidæ* and *O. pardalis* are—Length, 10 and 10; breadth, 3·8 and 3·3; length of aperture, 6·3 and 6·5.

3. **Oliva nymphalis**, *spec. nov.* Plate viii., fig. 7.

Shell acuminately oblong, with a moderate exsert spire, ending in a small subglobose tip; whorls five, narrowly channelled at the suture.

Very much like *O. nivea*, Gmelin, but it is more ventricose, wider, and not so deeply grooved at the suture; it also resembles *O. triticea*, Duclos, but has a shorter spire.

Dimensions.—Length, 10; breadth, 4·5; length of aperture, 6·5.

Localities.—Bairnsdale, Jemmy's Point, and Cunninghame, Gippsland (*W. H. Gregson !*); upper beds at Muddy Creek (*J. Dennant !*).

Genus Ancillaria.

Synopsis of species.

Enamel of spire spirally ridged.
- Spire acuminate; apex pointed; broadly depressed at suture. 1. *A. orycta.*
- Spire cylindrical; apex papillary. 2. *A. papillata.*
- Spire subscalar. 3. *A. subgradata.*

Enamel of spire without spiral ridges.
- Spire tumid; shell subcylindrical. 4. *A. hebera.*
- Spire tapering.
  - Non-callous surface of shell conspicuously spirally striated. 5. *A. subampliata.*
  - Non-callous surface plain or obscurely spirally striated.

Digitized by Google

Callosity of spire coarsely granulose.
6. *A. lanceolata.*
Callosity of spire smooth, or nearly so.
Spire subcylindrical, obtuse. 7. *A. ligata.*
Spire pyramidal, acute.
Elongate fusiform; aperture about half total length.
8. *A. semilævis.*
Aperture about two-thirds total length.
9. *A. pseud-australis.*

1. Ancillaria orycta, *spec. nov.* Plate x., fig. 5.

Shell stout, ovately fusiform; spire acuminate, with an acute tip, spirally ridged; last whorl rather ventricose, margined at the suture by a rather broad callous band, concavely and deeply depressed.

In shape and sculpture similar to *A. marginata*, but the apex is acutely pointed, and the whorls are broadly and deeply furrowed at the suture.

Dimensions of a large specimen :—Length, 23; breadth, 12; length of aperture, 14.

Localities.—Oyster-banks, Aldinga Cliffs; Jemmy's Point and Cunninghame, Gippsland (*W. H. Gregson !*); ferruginous sandrock, Cheltenham, Victoria.

2. Ancillaria papillata, *spec. nov.* Plate vii., fig. 4.

Shell solid, cylindrically oblong; spire pyramidally acuminate and mucronate, ending in a small blunt exsert pullus; the callous growth on the spire smooth, shining, microscopically granular, and sculptured with narrow, sharply rounded, spiral ridges of unequal size, the larger with two or three smaller ones interposed. Aperture a little more than half the total length.

Dimensions (mean).—Length, 25; breadth, 9·25; length of aperture, 14.

Locality.—Upper beds at Muddy Creek.

3. Ancillaria subgradata, *spec. nov.* Plate vii., fig. 8.

Shell thin, broadly fusiform, with a moderately long gradated spire ending in a small, smooth, swollen pullus; whorls rather ventricose, angulated near the posterior suture; the revolution of the suture marked by a raised thread.

This species recalls the recent Australian *A. cingulata*, but it has a much shorter spire, and the whorls are more sharply angled.

Dimensions.—Length, 29; breadth, 12·5; length of aperture, 15.

Locality.—Clayey green-sands Adelaide-bore.

Digitized by Google

4. Ancillaria hebera, *Hutton.* Plate vii., fig. 5.

Reference.—Catalogue Tertiary Moll. of N. Zealand, p. 6, 1873.

Synonym.—A. mucronata, *Johnston*, Geol. Tasmania, t. 31, f. 12, 1880.

Shell rather thin, cylindrical; spire short, thick, and bluntly rounded at the end; the callosity of the spire broader than the body-whorl, spirally constricted at the suture, coarsely granulose.

Dimensions (mean).—Length, 22·5; breadth, 9·25; length of aperture, 13·75.

Locatities.—Calciferous sandstones of the River Murray Cliffs near Morgan; lower beds at Muddy Creek; Table Cape *(Johnston!);* also in the Oamaru and Pareora systems in New Zealand.

The identification of the Australian specimens results from a comparison with an authentic example from New Zealand.

This species comes nearest to *A. olivula*, of the Paris basin, but the callosity is larger, gibbous, and granulated in our fossil.

5. Ancillaria subampliata, *spec. nov.* Plate vii, fig. 3.

Shell thin, fusiformly oblong, rather narrow, with an acuminate, subturreted spire, ending obtusely in a moderately large pullus of three smooth slightly convex whorls; callosity of spire spirally striated.

Body-whorl sculptured with revolving and longitudinal striæ; basal grooves wanting.

Aperture inflated anteriorly; columella hardly twisted, with slender plaits.

Dimensions.—Length, 34; breadth, 13; length of aperture, 24.

Locality.—Lower beds at Muddy Creek *(J. Dennant).*

This species has the form of *A. ampla*, Gmelin, but the spire is different in outline, and the surface of the body whorl is sculptured.

6. Ancillaria lanceolata, *spec. nov.* Plate vii., fig. 2.

Shell moderately stout, narrow, cylindrical; spire pyramidal, acuminately contracted at the apex, thickly covered with a coarsely granulated enamel. Somewhat intermediate between *A. hebera* and *A. pseud-australis.*

Dimensions (mean).—Length, 33·5; breadth, 10·75; length of aperture, 19·5.

Locality.—Lower beds at Muddy Creek.

7. Ancillaria ligata, *spec. nov.* Plate vii., fig. 6.

Shell small, oblong-cylindrical; spire sub-cylindrical, blunt, covered with a thin enamel; constricted at the suture and

Digitized by Google

bounded behind by a narrow flat band. In young specimens the callous growth occupies a broad zone around the anterior suture, leaving a dark coloured narrow belt at the posterior suture.

Dimensions.—Length, 19 ; breadth, 6 ; length of aperture, 9.

Localities—Turritella-clays at Blanche Point, Aldinga ; clayey green-sands, Adelaide-bore.

This resembles *A. semilævis*, T. Woods, but has a blunt apex, and is more strongly angled at the suture.

8. Ancillaria semilævis, *Tenison Woods.*

Reference.—Proc. Linnean Soc., N.S. Wales, 1879, p. 229, tab. 20, fig. 7.

A slender elongately fusiform shell, with the aperture less than half the total length ; spire acuminately pointed, slightly angled at the sutures ; callosity of spire minutely granular.

Dimensions.—Length, 19 ; breadth, 6 ; length of aperture, 9.

Localities.—Lower beds at Muddy Creek ; River Murray Cliffs ; Schnapper Point.

9. Ancillaria pseud-australis, *spec. nov.* Plate vii., fig. 1.

Shell stout, fusiformly ovate ; spire pyramidally acuminate, a little constricted anteriorly, thence tapering to a small mamillary pullus. Callus of spire obscurely spirally lined and minutely granulated.

Last whorl slightly ventricose, tumid in front of the suture. The two basal grooves each ending in a denticle on the outer lip. Columella twisted, with thin plaits.

Dimensions of a moderately sized specimen :—Length, 47 ; breadth, 19 ; length of aperture, 26·5.

Localities.—Lower beds at Muddy Creek ; River Murray Cliffs, near Morgan ; well-sinkings, Murray Desert; blue clays, Schnapper Point.

This species has been referred to the living species *A. australis* and *A. mucronata ;* from the former it is more markedly distinct. The Tasmanian conchologists believe that the latter species was founded on a fossil from Table Cape, but Sowerby's and Reeve's illustrations indicate a highly coloured and therefore presumably a living shell, and in my opinion a different shell from the fossil, which may be distinguished by its longer and constrictedly acuminate spire.

A. pseud-australis is not unlike *A. buccinoides* of the European Eocene, which is, however, less ventricose.

The unique specimen from a well-sinking in the Murray desert, represented by fig. 13, plate vi., is provisionally referred to *A. pseud-australis* as an obtuse variety resembling *A. obtusa* from Cape of Good Hope. Detached spires similar to that of this

Digitized by Google

variety, attaining to a diameter of 31 mills., occur in the River Murray Cliffs, but the perfect shell is yet unknown.

Genus Harpa.

SYNOPSIS OF SPECIES.

Whorls rounded at the shoulder.
  Pullus turbinate; lamellæ thin, elevated, about 50 on last whorl. 1. *H. lamellifera.*
Whorls angulated or sub-angulated at the shoulder.
  Whorls sulcated around suture; lamellæ thin, about 40 on last whorl. 2. *H. sulcosa.*
  Spire whorls sub-quadrate; strongly ribbed spirally and axially; spire more than half length of aperture. 3. *H. spirata.*
  Whorls upward-sloping to posterior suture.
    Spire whorls roundly angled.
      Spire less than one-fifth length of aperture; ribs on last whorl, 12, conspicuously lirate above and below angulation of last whorl. 4. *H. cassinoides.*
      Spire less than one-third length of aperture.
        Pullus papillary, nucleus small, lateral; outer lip slightly expanded.
          Lamellæ on last whorl about 20, transversely striate; no liræ 5. *H. abbreviata.*
          Lamellæ on last whorl about 25, lirate and transversely striate. 6. *H. tenuis.*
        Pullus large, hemispheric.
          Lamellæ about 25 on last whorl; outer lip thickened. 7. *H. pulligera.*
      Spire whorls bicarinate at periphery, costæ and liræ distant and prominent. 8. *H. clathrata.*

1. Harpa lamellifera, *spec. nov.* Plate vi., fig. 2.

Shell ovate, ventricose; spire very short, ending in a moderately large turbinate pullus of two smooth rounded whorls, the last half turn almost concealed. Ordinary whorls, two and a half, convex; ornamented with thin elevated lamellæ, about 50 on the last whorl; interspaces finely transversely striate and spirally lined. Aperture lunate; outer lip not thickened, sigmoidally curved coincident with the lamellæ.

Dimensions.—Length, 29; breadth, 19; length of aperture, 24; width, 10.

Locality.—Lower beds at Muddy Creek.

Digitized by Google

2. Harpa sulcosa, *spec. nov.* Plate vi., fig. 10.

Shell ovate, ventricose; spire short, scalar, ending in a large pullus of two smooth turns, the last turn subglobose, with the tip laterally immersed. Ordinary whorls, two and a half, flatly channelled at the suture; ornamented with thin subdepressed lamellæ, about 40 on the last whorl, which terminate at the shoulder in small vaulted scales; interspaces indistinctly striate, and inconspicuously distantly spirally lined. The flat or slightly concave posterior area of the whorls spirally striated and traversed by the depressed lamellæ.

Aperture lunate, truncated posteriorly corresponding with the sutural depression; outer lip not thickened, sigmoidally curved.

Dimensions.—Length, 19; breadth, 11·5; length of aperture, 15.

Locality.—Lower beds at Muddy Creek.

3. Harpa spirata, *spec. nov.* Plate vi., fig. 3.

Shell oval-oblong, with a high subscalar spire, ending in a hemispheric pullus. Ordinary whorls, three and a half, bluntly angled in front of the suture, the posterior area flat or slightly sloping upwards. Ornamented with stout depressed lamellæ, about 30 on last whorl, and distant spiral ribs about three on penultimate whorl; interspaces between the lamellæ finely transversely striate.

Aperture oval-oblong; outer lip thickened and reflected.

Dimensions.—Length, 35; breadth, 22; length of aperture, 25.

Locality.—Blue clays at Schnapper Point.

4. Harpa cassinoides, *spec. nov.* Plate vi., fig. 4.

Shell stout, biconic, with a very short somewhat acuminate spire ending in a small papillary pullus of two turns.

Ordinary spire-whorls two, medially angled, with a slight concave posterior area; ornamented with distant ribs which rise into blunt tubercles on the angulation.

Last whorl oval, ventricose, flatly rounded over the suture, and rapidly attenuated at the base; periphery with three equal and equidistant liræ; axial ribs twelve, subangular, sigmoid, somewhat elevated into blunt tubercles on the peripheral liræ.

Aperture lunate; outer lip ascending on the penultimate whorl, very much thickened and somewhat patulously spreading.

Dimensions.—Length, 28; breadth, 23; length of aperture, 27.

Locality.—Well-sinking, Murray Desert.

5. Harpa abbreviata, *spec. nov.* Plate vi., fig. 7.

Shell thin, narrow-oval, with a short spire ending in a moderate sized blunt apex. Ordinary spire-whorls two, subangulated medially, with two spiral threads at the periphery, and ornamented by rather distant, hardly raised lamellæ.

Digitized by Google

Last whorl oval-oblong, somewhat ventricose, flatly rounded over the suture; ornamented with about twenty, thin, hardly elevated lamellæ; interspaces axially striated.

Aperture oval-oblong; outer lip ascending to periphery of penultimate whorl, somewhat patulously expanded, especially at the two ends.

Dimensions.—Length, 27; breadth, 17; length of aperture, 24.

Locality.—Lower beds at Muddy Creek.

6. Harpa tenuis, *spec. nov.* Plate vi., fig. 1.

Shell thin, oval, with a rather short spire, ending in a rather large blunt apex. Ordinary spire-whorls two, convex, but with an ill-defined ante-medial angulation; ornamented with thin, slightly elevated lamellæ, and transversely interstriated.

Last whorl oval, slightly ventricose over the suture; ornamented with about 25 thin, slightly elevated lamellæ, which develope vaulted pointed scales on the shoulder, and with distant, not prominent, flat spiral threads, which are more conspicuous on the base in the form of wrinkled corrugations.

Dimensions.—Length, 36; breadth, 23; length of aperture, 29.

Locality.—Lower beds at Muddy Creek.

7. Harpa pulligera, *spec. nov.* Plate vi., fig. 9.

Shell thin, oval, with a rather short spire, ending in a very large hemispheric pullus, with the tip laterally immersed; the second turn of the pullus almost concealed by the first ordinary whorl. Ordinary whorls one and a half, subangulated; ornamented with thin, slightly elevated lamellæ, which are vaulted on the angulation.

Last whorl oval-oblong, somewhat ventricose over the suture, ornamented with about 25 thin, slightly elevated lamellæ, which are raised into vaulted scales on the shoulder; the interspaces with coarse axial striæ; base spirally wrinkled.

Aperture narrow-oval; outer lip slightly ascending on the penultimate whorl, its margin much thickened.

Dimensions.—Length, 50; breadth, 30; length of aperture, 42; diameter of pullus, 4·5.

Locality.—Blue clays at Schnapper Point.

8. Harpa clathrata, *spec. nov.* Plate vi., fig. 8.

Shell moderately stout, narrow-oval, with a short spire ending in a moderately sized papillary pullus. Ordinary spire-whorls two, angulated medially, and with a strong thread between the angulation and the anterior suture, and ornamented with distant thin angular costæ, the interspaces with a few transverse wrinkles of growth.

Last whorl oval, somewhat ventricose and flatly rounded over

Digitized by Google

the suture, attenuated at the base; ornamented with about 18 angular costæ, and about 20 equal and equi-distant broad flat liræ, but narrower than the interspaces; the whole surface with conspicuous wrinkles of growth.

Dimensions.—Length, 36; breadth, 21; length of aperture, 30.

Locality.—Calciferous sandstones, River Murray cliffs, near Morgan.

FAMILY CANCELLARIDÆ.

Genus Cancellaria.

SYNOPSIS OF THE SPECIES.

Shell umbilicated.
- Whorls lirate and costulated, deeply channelled at the suture; widely umbilicated. 1. *C. calvulata.*
- Whorls lirate, costæ broad, widely channelled; narrowly umbilicated. 2. *C. laticostata.*
- Whorls spirally ribbed, fenestrated by fine threads; suture not channelled; widely umbilicated. 3. *C. alveolata.*

Shell imperforate.
- Whorls variced.
  - Suture channelled; strongly lirate.
    - Interspaces between spiral ribs finely striate. 4. *C. epidromiformis.*
    - Interspaces with a strong thread. 5. *C. exaltata.*
  - Suture not channelled; finely lirate. 6. *C. varicifera.*
- Whorls not variced.
  - Whorls squarely shouldered.
    - Whorls more or less tessellated; shell oval.
      - Liræ on last whorl more than 10; posterior area with a spiral thread. 7. *C. gradata.*
      - Liræ on last whorl about 10. 8. *C. ptychotropis.*
    - Whorls strongly costated; spire turreted. 9. *C. turriculata.*
  - Whorls rounded.
    - Shell oval.
      - Costæ well developed, roundly angular, extending to base of last whorl. 10. *C. Wannonensis.*
      - Costæ rounded, thick, on medial portion of last whorl only. 11. *C. semicostata.*
      - Lirate without costæ. 12. *C. modestina.*

Digitized by Google

Shell turriculate.
Penultimate whorl subangulate with subtuberculose costæ and 4 liræ.
Last whorl with about 20 liræ; penultimate whorl with 10 costæ.
13. *C. Etheridgei.*
Last whorl with 10 liræ; penultimate whorl with 12 costæ; finely striated transversely. 14. *C. caperata.*
Penultimate whorl convex with slender costæ, and 7 to 10 liræ.
Costæ nodosely crenulate; last whorl rather ventricose.
15. *C. capillata.*
Costæ arcuate, thin; liræ fewer.
16. *C. micra.*

1. Cancellaria calvulata, *spec. nov.* Plate ix., fig. 3.

Shell ovately ventricose, rather thin; spire moderate, turbinated, ending in an eccentric pullus of one and a half smooth swollen whorls. Whorls three, excluding pullus, very convex, separated by a rather narrow and deep channelled suture, the shoulder rounded. Sculptured with rounded spiral ribs alternately large and small (about fifteen on penultimate whorl), with obscure transversely oblique plications (about twenty on penultimate whorl), which crenulate the liræ, and with close-set transverse thread-like striæ.

Aperture ovate, sharply angled at the front; outer lip thin, a little spreading, crenulate on the edge, and strongly and closely ribbed within; columella oblique with three plaits; umbilicus moderately wide and deep.

Dimensions.—Length, 16; breadth, 12; length of aperture, 10; diameter of umbilicus, 2.

Locality.—Blue clays at Schnapper Point.

By its rounded whorls and ornament it differs from all living species of the Section Trigonostoma, but has much resemblance to *C. expidea*, of the Piedmontese Pliocene, from which it differs by its more exsert spire, narrow channel, and the more numerous transverse plications.

2. Cancellaria laticostata, *Tenison Woods.*

Reference.—Proc. Lin. Soc., N.S. Wales, vol. iv., tab. 2, fig. 8, p. 17; 1879.

A small ovate shell, spire obtusely turreted, whorls separated by a deep channel, broadly ribbed (10 on last whorl), decussate. Aperture entire, angular; outer lip simple, ribbed within; colu-

Digitized by Google

mella with two stout plaits, umbilicus narrow and deep. Length, 6 ; breadth, 3·5.

Locality.—Lower beds at Muddy Creek !

C. laticostata may be regarded as a diminutive *C. hæmastoma*, Sowerby, from the Gallapagos Islands, but has a little longer spire and broader plications.

The species name is preoccupied by Kuster for a recent shell, which is probably *C. sinensis*, Reeve, a variety of *C. asperella*, Lamarck, but under the circumstances it is not desirable to substitute another name for our fossil.

3. Cancellaria alveolata, *spec. nov.* Plate x., fig. 7. *a-b.*

Shell small, thin, ovate-ventricose ; spire short, turbinate ending in a small blunt pullus of one and a half smooth depressed turns.

Whorls three and a half, moderately convex, separated by a linear channelled suture ; equally and equidistantly lirate, five on the penultimate whorl, the posterior one margining the suture ; liræ rounded, depressed, about equal in width to the interspaces, which are roundly pitted by the intercrossing of slender sigmoid threads. Aperture ovately oblong, angularly rounded at the front, but not channelled ; outer lip varicosely thickened, the edge inflected and crenulated, smooth within, slightly insinuate at the suture; peristome entire; columella arched, obscurely one-plicate. Perhaps not a *Cancellaria.*

Dimensions.—Length, 4·5 ; breadth, 3 ; length of aperture, 3.

Locality.—Lower beds at Muddy Creek.

4. Cancellaria epidromiformis, *spec. nov.* Plate viii., fig. 9.

Shell thick, ovately elongate, with a sub-turreted spire ending in a small obtuse apex of one and a half turns. Whorls five, excluding pullus, convex, narrowly and deeply excavated at the suture, the shoulder rounded and coronated ; varices four, at irregular intervals ; ornamented with slender, oblique, subacute costæ (about 24 on penultimate whorl) and spiral liræ (about five on penultimate whorl), bluntly tuberculose or granulose at the junctions ; interspaces between the liræ with about four or five threads, minutely granular or scaly produced by close-set longitudinal striæ.

Aperture oblong ; outer lip varicosely thickened, plicate within; columella lip expanded, columella with three stout plaits ; body-wall with a stout spiral ridge and a few carunculations.

Dimensions.—Length, 20 ; breadth, 10 ; length of aperture, 10.

Locality.—Lower beds at Muddy Creek.

5. Cancellaria exaltata, *spec. nov.* Plate viii., fig. 10.

Shell like *C. epidromiformis*, but rather narrower, with the sutural channel less defined, and with certain differences of orna-

Digitized by Google

mentation. The costæ are acute, slightly curved, about 16 on penultimate whorl, and about five sharp spiral liræ which serrulate the costæ; the interspaces between the liræ with one to three stout threads; the whole surface with longitudinal threads or coarse striæ, which do not produce so fine and close sculpturing on the spiral threads as in the allied species.

Dimensions.—Length, 19·5; breadth, 8·5; length of aperture, 9.

Locality.—Blue clays at Schnapper Point.

This species recalls *C. macrospira* of the China Seas, but is not so elongate, with a narrower channelled suture and strong costæ; moreover, the recent species is semi-pellucid, and has a minute umbilicus.

6. Cancellaria varicifera, *Tenison Woods.*

Reference.—Proc. Lin. Soc., N.S. Wales, vol. 3, tab. 21, f. 12, p. 231, 1878.

Shell ovate, spire elevated, subacute, variced, solid, ending in a small smooth pullus of 1½ turns. Whorls five, convex, longitudinally costated, costæ slender, arched (about 20 on penultimate whorl), and regularly lirate (about 15 on penultimate whorl); distantly cancellated by longitudinal stout striæ. Outer lip thin, lirate within; columella triplicate.

Dimensions.—Length, 19; breadth, 9; length of aperture, 7.

Localities.—Lower beds at Muddy Creek; River Murray Cliffs; blue clays at Schnapper Point.

This is the antipodean analogue of *C. evulsa*, Solander, of the European Eocene, differing only by its much finer ornament, and by the liræ within the outer lip.

7. Cancellaria gradata, *spec. nov.* Plate x., fig. 12.

Shell thin, broadly ovate, carinate, with a moderately long, acute, scalar spire, ending in a small pullus of one and a half very convex turns.

Whorls four and a half, excluding pullus, flattened above, angulated in the posterior one-third, of regular increase; the last whorl is large and ventricose, with an elongated convex base and a very small broad beak. Suture impressed. Anterior portion of whorls tessellated by acute spiral ridges (six on the penultimate) and more slender, straight transverse threads, producing very small acute tubercles at the intersections; the oblong depressed interspaces transversely striated.

The keel is serrately crenulated; the posterior area with a median spiral thread, arched transverse striæ, and oblique plications, which become obsolete before reaching the suture.

Aperture quadrately oval, angulated at the keel and at the base of the pillar. Outer lip crenulated on the thin edge, lirate within.

Digitized by Google

Columella with a slight twist at the front, and with three distinct folds above it.

Dimensions.—Length, 13·5; breadth, 7; length of aperture, 7.

Localities.—Lower beds at Muddy Creek. Calciferous sandstone, River Murray Cliffs, near Morgan.

8. Cancellaria ptychotropis, *spec. nov.* Plate ix., fig. 5.

Shell broadly ovate, similar to *C. gradata*, but the spiral liræ and transverse threads are fewer and more distant, and the posterior area of the whorls is without a spiral thread, whilst the liræ are simply crenulated and not tuberculated.

Dimensions.—Length, 6·25; breadth, 3·5; length of aperture, 3·5.

Locality.—Turritella-clays at Blanche Point, Aldinga Bay.

9. Cancellaria turriculata, *spec. nov.* Plate x., fig. 14.

Shell oval-turreted, carinate, rising in high narrow steps, ending in a broad, blunt, conical pullus. Whorls four, excluding pullus, narrowly flattened above, of regular increase; ornamented with sub-acute, distant, slightly curved costæ (about 11 on the penultimate), which are tuberculosely thickened at the keel, and with slender spiral threads in front of the keel (about six on penultimate whorl).

Last whorl narrow, with an elongate convex obtuse base; costate and lirate; aperture elliptical, roundly angled at the keel; columella with two small plaits.

Dimensions.—Length, 5·75; breadth, 2·5; length of aperture, 2.

Localities.—Turritella-clays, Blanche Point, Aldinga Bay; clayey green-sands, Adelaide-bore.

10. Cancellaria Wannonesis, *spec. nov.* Plate viii., fig. 11.

Shell stout, fusiformly ovate, ventricose; spire sharply acuminate, ending in a sub-cylindric pullus of two and a half turns. Whorls 4, excluding pullus, flatly convex posteriorly, then regularly rounded to the front; strongly ribbed and spirally lirate.

Last whorl with about 10 to 12, narrowly rounded, elevated, obliquely arched ribs, most prominently elevated in the median portion of the whorl, becoming obsolete at the front; costæ serrately crenulated by numerous spiral angular liræ, alternately large and small; the liræ somewhat rugulose on the edge by the crossing of transverse striæ and folds of growth.

Aperture broadly ovate, rounded behind and rather truncated in front; outer lip arcuate, somewhat effuse anteriorly, its edge sharp and obscurely crenulate. Columella nearly straight, with three plaits, the posterior of which is the stoutest; in senile examples a fourth plait is interposed between the second and

Digitized by Google

third, and a few ridges appear on the columella-callus which is thinly spread over the umbilical region.

Dimensions.—Length, 29 ; breadth, 17 ; length of aperture, 20; width, 9.

Localities.—One of the commonest fossils in the upper beds at Muddy Creek; Jemmy's Point, Gippsland Lakes (*W. H. Gregson!*)

Has some resemblance to a small group of recent species gathering around *C. ventricosa*, Hinds, and *C. candida*, Sowerby.

11. Cancellaria semicostata. *spec. nov.* Plate x., fig. 3.

Shell minute, stout, oval; whorls three and a half; spire-whorls very convex; penultimate whorl with ten thick rounded costæ, evanescent at the posterior suture. Last whorl not so ventricose as the penultimate, the first half turn with thick costæ on the median portion, becoming obsolete with the revolution of the whorl.

Aperture oval, rounded at each end; outer lip thin, smooth within; inner lip defined by a small chink behind the pillar; columella, with a slight effuse base and two thick hardly elevated plaits above.

Dimensions.—Length, 3 ; breadth, 2 ; length of aperture, 2.

Locality.—Lower beds at Muddy Creek.

Doubtlessly an immature shell, but differs from the posterior whorls of any associated species.

12. Cancellaria modestina, *spec. nov.* Plate ix., fig. 4.

Shell stout, oblong-ovate; spire short, with an obtuse apex. Ordinary whorls three, slightly convex, a little depressed at the posterior suture; spirally grooved, and transversely obsoletely ridged, not plicate. There are about ten flatly rounded liræ, separated by linear grooves on the penultimate whorl; rudely cancellated by the obsolete transverse threads.

Aperture ovate; outer lip thin-edged, lirate within; columella with three moderately stout plaits.

Dimensions.—Length, 12; breadth, 7; length of aperture, 7·5.

Locality.—Upper beds at Muddy Creek.

Bears a close resemblance to *C. purpuriformis*, Valenciennes, which has obsolete plications and stouter columella-plaits.

13. Cancellaria Etheridgei, *Johnston.* Plate ix., fig. 6.

Reference.—Proc. Roy. Soc., Tasmania, for 1879.

Shell turriculate; whorls five, convex, slightly angled posteriorly, distinctly ribbed on posterior whorls, crossed by five angular liræ, which are obsoletely nodose at the intersections. Last whorl lirate, except on the narrow posterior slope; ribbed for about a half turn; the ribs gradually become less distinct with the revolution of the whorl, and on the last half turn are obsolete.

Digitized by Google

Aperture ovate; outer lip arched, thin edged, with about five strongly spiral ribs within; columella incurved, with two plaits situated high up.

Dimensions.—Length, 7; breadth, 3; length of aperture, 2·5.

Locality.—Table Cape *(R. M. Johnston!).*

14. Cancellaria caperata, *spec. nov.* Plate ix., fig. 7.

Shell small, stout, elongate-oval, ending in an obtuse pullus of one and a half smooth subglobose turns.

Whorls three and a half, excluding pullus, convex, sloping more rapidly to the posterior suture. Ornamented with rounded, depressed costæ, and with spiral threads in front of the angulation, forming crenate-nodosities at the intersection, conspicuously so on the posterior thread; the whole surface finely transversely striated; penultimate whorl with three strong spiral threads and a slender one at the anterior suture. Last whorl with about ten spiral liræ, costæ inconspicuous. Aperture oblong, rounded at each end, peritreme entire; outer lip strongly lirate within; columella with three transverse plaits.

Dimensions.—Length, 5; breadth, 2·5; length of aperture, 2.

Locality.—Blue clays, Schnapper Point.

15. Cancellaria capillata, *spec. nov.* Plate x., fig. 10.

Shell small, stout, elongate-oval, apex obtuse; whorls six, convex, lirate and slenderly costated. The spiral liræ increase in number from four on the first ordinary whorl to ten on the penultimate whorl; and produce slight nodose-crenulations on the costæ.

Last whorl more ventricose than the preceding one, somewhat varicosely dilated here and there; spirally lirate all over, costæ obsolete.

Aperture oblong, peritreme continuous; outer lip, lirate within; columella with two small transverse plaits.

Dimensions.—Length, 6; breadth, 3; length of aperture, 2·5.

Locality.—Lower beds at Muddy Creek.

16. Cancellaria micra, *spec. nov.* Plate x., fig. 8.

Resembles *C. capillata*, but the costæ are much arcuate and thin, the spiral threads fewer (seven on the penultimate whorl), the whorls a little flattened posteriorly, and the outer lip is smooth within.

Dimensions.—Length, 3·5; breadth, 1·75; length of aperture, 1·5.

Locality.—Clayey green-sands, Adelaide-bore.

Digitized by Google

FAMILY TEREBRIDÆ.

Genus Terebra.

SYNOPSIS OF THE SPECIES.

Shell with a smooth band in front of suture, defined by a sulcus.
1. *T. platyspira.*

Shell with a tuberculate or plicate band in front of suture, defined by a constriction.

A double row of nodulations on posterior half of whorl.

The rows of nodulations separated by a sculptured area.
2. *T. catenifera.*

The rows of nodulations contiguous.
3. *T. subcatenifera.*

Transversely plicate on posterior whorls; anterior ones smooth. 4. *T. mitrellæformis.*

Whorls varicosely costated. 5. *T. crassa.*

Costæ bent, subnodulose. 6. *T. geniculata.*

Transversely plicate throughout.

Narrowly cylindrical; pullus large, sub-globose.
7. *T. mutica.*

Broadly pyramidal; plicæ stout. 8. *T. subspectabilis.*

Narrowly pyramidal; plicæ slender; pullus cylindric.
11. *T. additoides.*

Shell without an ante-sutural band on the anterior whorls.

Transversely striated or wrinkled.

Posterior whorls flat; spire regular.
9. *T. simplex.*

Posterior whorls sub-angulated; spire acuminate.
10. *T. angulosa.*

Slenderly costated.

Anterior whorls sloping to the posterior suture.
11. *T. additoides.*

Whorls flat; ribs obsolete on anterior whorls.
12. *T. leptospira.*

Whorls convex, coronated at the suture.
13. *T. convexiuscula.*

SPURIOUS SPECIES.

Terebra scalaris, *Tate*, is transferred to *Cerithiopsis.*

1. Terebra platyspira, *Tate.* Plate viii., fig. 12.

Reference.—Southern Science Record, January, 1886, p. 6.

Shell narrow-elongate, of many flat whorls of slow increase, terminating in a relatively large papillary pullus of two turns; the first turn of the pullus subglobose, with the tip reverted and immersed, much broader than the next two or three whorls.

Digitized by Google

Ordinary whorls flat, separated by a slightly excavated suture, and having a linear spiral sulcus at the posterior-fourth; ornamented with transverse curvilinear flat ridges or wrinkles, and a few spiral flat threads medially and linear grooves near the anterior suture; the spiral ornament is only conspicuously developed on the anterior whorls of larger examples. The first five spire-whorls faintly costated.

Dimensions of figured specimen of 25 whorls:—Length, 47; width of last whorl, 6. The largest examples attain to 60 mills. in length.

Locality.—Lower beds at Muddy Creek.

This is very distinct from any living species.

2. Terebra catenifera, *Tate.* Plate viii., fig. 14.

Reference.—Southern Science Record, January, 1886, p. 5.

Shell pyramidal, elongate, of many polished whorls, ending in a papillary pullus of two rather large, smooth, convex turns.

Whorls convexly flattened, slightly overlapping; double banded and nodulose in front of the suture, the posterior band rather the broader, and separated by a shallow sulcus, in the centre of which winds a subangular ridge defined by linear grooves; about twenty pairs of nodulations on the penultimate whorl; anterior half of each whorl distantly and superficially spirally ridged; the whole surface arcuately striated by lines of growth; base spirally ridged and transversely wrinkled.

Dimensions.—Length of 17 whorls, 38; breadth of last whorl, 7.

Locality.—A common fossil in the upper beds at Muddy Creek.

It has much resemblance to the Japanese species, *T. serotina*, Adams & Reeve.

3. Terebra subcatenifera, *spec. nov.**

Shell similar to *T. catenifera*, but the double row of nodulations, which are very much larger, are separated by a linear furrow; the anterior half of each whorl is sculptured with four equidistant spiral grooves separated by much wider flat ridges; a more or less distinct transverse angular ridge is decurrent from each tubercle of the anterior row to the anterior suture.

Dimensions.—Length of 15 whorls, 25; width of last whorl, 5·5.

Localities. — Cunninghame and Jemmy's Point, Gippsland *(W. H. Gregson!).*

4. Terebra mitrellæformis, *Tate.* Plate ix., fig. 10.

Reference.—Southern Science Record, January, 1886, p. 7.

Shell cylindrically subulate, polished; whorls convex; upper whorls distinctly costated, interrupted near the suture by a

*A figure is postponed to Part III.

Digitized by Google

narrow sulcus, otherwise smooth. The plications are slightly arcuate and attenuated above and below; becoming almost obsolete on the anterior whorls.

Dimensions.—Eight whorls in a length of 9 mill.; breadth of last whorl, 2·5.

Locality.—Oyster-beds of the Upper Aldinga Series, Aldinga Bay.

The specific name of this fossil indicates its resemblance to Mitrella of the Columbellidæ; amongst species of which it comes near to *M. Lincolnensis*, but apart from the different characters of the aperture, the fossil shell is more slender than juvenile specimens of the living Mitrella. In respect to shape and ornament *T. mitrellæformis* would seem to approach to *T. nana*, Deshayes, inhabiting off the mouth of the Indus, but that species is without a sutural band.

5. Terebra crassa, *Tate.* Plate ix., fig. 10.

Reference.—Southern Science Record, January, 1886, p. 7.

Shell subcylindrical, whorls flatly convex, slighly flattened at the suture, ornamented with thick costæ separated by narrow angular interspaces, and interrupted at the posterior-third by a narrow and deep sulcus. There are about 20 costæ on the last whorl.

Dimensions.—About 10 whorls in a length of 17 mills.; breadth of last whorl, 4·5.

Locality.—Oyster beds of the Upper Aldinga Series, Aldinga Bay, South Australia.

This species bears a resemblance to some varieties of *T. dislocata* (Say), but it is narrower and more coarsely ornamented.

6. Terebra geniculata, *Tate.* Plate ix., fig. 8.

Reference.—Southern Science Record, January, 1886, p. 6.

Shell cylindrical, many-whorled, polished; pullus subacute of three small convex turns; whorls convex or subangulate; constricted around the posterior part, between which and the suture there is a row of tubercles (about twelve on the last whorl); the rest of the whorl is ornamented with distant varicose ribs, the interstices being spirally striated and faintly marked with lines of growth.

The ribs are stout, subcompressed, and abruptly bent and subnodose on the angle of the whorl; they are confluent with and equal in number to the tuberculations on the band next the suture.

Dimensions.—Length of 13 whorls, 12; breadth of last whorl, 3.

Locality.—Upper beds at Muddy Creek.

Digitized by Google

The narrow tuberculose band and the geniculate varicose costæ distinguish this species.

7. Terebra mutica, *spec. nov.* Plate x., fig. 1.

Shell small, narrowly cylindrical, ending in a relatively large subglobose pullus of one and a half turns. Ordinary whorls six and a half, flatly convex, separated by an impressed suture, transversely plicate.

Plicæ stout, slightly arched, subnodulose near the suture, interrupted in the posterior-third or so by a broad shallow constriction, there are about 20 on the penultimate whorl; axial furrows obscurely longitudinally striated; base smooth.

This species has some resemblance to the young of *T. additoides*, but is much narrower, has more plications and a different pullus.

Dimensions.—Length, 7; breadth of last whorl, 1·75.

Locality.—Lower beds at Muddy Creek.

8. Terebra subspectabilis, *spec. nov.* Plate ix., fig. 11.

Shell stout, rather broadly pyramidal, apex obtuse, of one and a half turns. Ordinary whorls seven, flatly convex, suture linear, transversely plicate. Plicæ stout, subangular, nearly straight, interrupted in the posterior-third by a very broad shallow constriction there are about twenty on the penultimate whorl; base obscurely spirally wrinkled.

This species differs from *T. mutica* by its shape, and from *T. additoides* by being broader, and by its stout plicæ, different pullus, and antesutural constriction.

Dimensions.—Length, 18; breadth of last whorl, 5.

Locality.—Upper beds at Muddy Creek.

9. Terebra simplex, *Tenison Woods.*

Reference.—Proc. Roy. Soc., Tasmania, for 1875, p. 21, tab. 1, fig. 1.

This species has the general form of *T. maculata*, Linnæus, but the whorls are slightly shouldered and strongly arcuately wrinkled transversely; the posterior whorls have straight, distant, angular plications. There is no infra-sutural groove, though the anterior whorls of large examples show a faint depression in the posterior-third.

Dimensions of largest examples of 15 whorls:—Length, 70; breadth of last whorl, 15 millimetres.

Localities.—Table Cape, Tasmania *(T. Woods);* lower beds at Muddy Creek, Hamilton, Victoria *(R. T.)*.

The specific name given to this fossil is preoccupied by a Californian shell described by P. Carpenter; but as that "is very probably a minor variety of *T. variegata* (Gray)," Tryon, there is no need to apply a new designation.

Digitized by Google

10. Terebra angulosa, *spec. nov.* Plate viii., fig. 13.

Shell stout, pyramidal, with a somewhat acuminate spire ending in a papillary pullus of two turns, the extreme tip of which is sub-erect.

The three anterior whorls are flatly convex, faintly obliquely plicate; the next four whorls sub-angulate in the posterior-third, stoutly wrinkled transversely; the anterior whorls are a little swollen over the suture and obscurely depressed in the posterior-third, sigmoidally flatly wrinkled and striated transversely, and neatly and closely striated spirally.

Dimensions.—Length of 14 whorls, 53; breadth of last whorl, 12.

Locality.—Well-sinking, Murray Desert.

The shape of the whorls and the outline of the spire, if they prove constant, distinguish this species from *T. simplex.*

11. Terebra additoides, *Tenison Woods.*

Reference.—Proc. Roy. Soc. Tasmania for 1876, p. 95.

The pullus is sub-cylindrical and consists of about four narrow convex whorls. The posterior of the ordinary whorls have a narrow ante-sutural band, whilst the anterior ones are sub-angulated coincident with the constriction, all are plicated; the plicæ are very narrow, acute, slightly bent, sub-nodulose near the suture of the posterior whorls or on the angulation of the anterior ones; the interspaces between the plicæ are finely and closely reticulated.

Dimensions of specimen having 13 whorls:—Length, 24; breadth of last whorl, 5.

Localities.—Table Cape (*T. Woods* and *R. M. Johnston!*); River Murray Cliffs near Morgan.

The specific name indicates its affinity with *T. addita*, Deshayes.

12. Terebra leptospira, *spec. nov.* Plate viii., figs. 15*a-b.*

Shell slender, elongate, of many narrow whorls of slow increase, ending in a pyramidal pullus of four rapidly diminishing rounded turns.

Ordinary whorls flat, the posterior ones with straight, slender, angular plications; diminishing to stout oblique wrinkles on the anterior whorls, which are slightly depressed at the posterior one-third.

Dimensions.—Length of 17 whorls, 27; breadth of last whorl, 4.

Locality.—Lower beds at Muddy Creek.

13. Terebra convexiuscula, *spec. nov.* Plate x., fig. 4.

Shell narrowly pyramidal; whorls convex; suture distinct; transversely plicate; plicæ curved, thick, subangular, coronated at the suture, about 30 on the last whorl.

Dimensions.—Length of 9 whorls, 6; breadth of last whorl, 15.

Locality.—Upper beds at Muddy Creek.

Digitized by Google

FAMILY CASSIDIDÆ.

Genus Cassis.

SYNOPSIS OF SPECIES.

Shell oblong-ovate, 12 tubercles in each row in front of the last varix; posterior slope of last whorl precipitous; suture margined with granulose-crenulations. 1. *C. exigua.*

Shell ovate, 9 tubercles in each row, posterior slope concavely sloping upwards, distantly wrinkled at the suture. 2. *C. textilis.*

SPECIES EXCLUDED.

C. sufflata, *Tenison Woods*, is tranferred to *Semicassis.*

1. Csssis exigua, *Tenison Woods.* Plate vii., fig. 13.

Reference.—Proc. Lin. Soc., N.S. Wales, vol. iv., p. 17, tab. 2, fig. 7 (1879).

Shell stout, oblong-ovate, ventricose, with a very short conic spire, ending in a small pullus of one and a half smooth swollen turns, with the tip reverted and immersed. Whorls five, excluding pullus, varied at successive intervals of about two-thirds of a whorl, the first whorl transversely corrugate and spirally striate; sutures granulosely marginate.

Last whorl with a very high back, somewhat precipitous over the suture; bearing on the angle a row of 12 compressed sharp-pointed tubercles, and on the medial portion two other rows equidistantly placed, but of smaller size, a fourth inconspicuous row is developed on the adult shell. Base somewhat cancellated.

Aperture narrow, sinuously curved at each end; outer lip flattened, inflected, and slightly reflected, plicately dentate. Inner lip widely spreading, projecting behind as a thin plate, and terminated by the varix, over which it projects. Columella strongly dentately wrinkled throughout, as well as the anterior portion of the callous-covering.

Dimensions.—Length, 40; breadth of last whorl, 30; height, 27; length of aperture, 37; but attains to a length of 52.

Locality.—Lower beds at Muddy Creek.

It is hardly possible to recognise in the shell, which I have figured, an adult example of the very juvenile specimen which is the author's type of the species; but I have had that under examination, and have been able readily to trace it through a long series of graduating specimens.

In its adult state the species closely resembles *C. fimbriata*, recent in Southern Australia, from which it differs particularly by the spiral sculpture.

Digitized by Google

2. Cassis textilis, *Tate.* Plate vii., fig. 11.

Reference.—Trans. Roy. Soc. South Australia, vol. v., p. 45, 1882.

Shell stout, ovate, ventricose, with a short conic spire ending in a small sub-globose pullus, the tip reverted and immersed. Whorls five, excluding pullus, with varices at successive intervals of about two-thirds of a whorl, ornamented with numerous spiral threads crossed by folds of growth, wrinkled at the suture. Last whorl bearing on the superior angle a row of nine nodular tubercles, and on the medial portion two other rows equi-distantly placed, the tubercles of which are smaller, much more so are those of the anterior row. Posterior area concavely sloping backward to the suture.

Outer lip thickened, margin plain. Columellar callus dentate; columella very tortuous beneath the callus, canal recurved.

Dimensions.—Length, 45; breadth of last whorl, 32; height, 29; length of aperture, 31.

Localities.—Calciferous sandstones of the River Murray cliffs near Morgan; sand-rock, Cheltenham, Port Philip Bay. Casts presumably of this species occur in the oyster banks at Adelaide and Aldinga; in the crystalline limestone of the Bunda Cliffs of the Great Australian Bight; in the raggy limestones at Mannum on the River Murray.

This species differs in shape from the recent *C. fimbriata* and its fossil representative *C. exigua* by being more ventricose and by its longer spire. Its spiral ornamentation and triple row of tubercles further distinguish it from *C. fimbriata.*

Genus Semicassis.

SYNOPSIS OF SPECIES.

Aperture not exceeding two-thirds of total length; surface of whorls spirally and longitudinally sculptured.

Whorls sub-angulate, with cancellate sculpture. 1. *S. transenna.*

Whorls convex, longitudinally costate, and spirally ribbed. 2. *S. subgranosa.*

Aperture at least two-thirds of total length; last whorl lirate or ribbed, not cancellate.

Last whorl spirally ribbed on posterior area. 3. *S. Muelleri.*

Last whorl spirally ribbed all over, three nodulose ribs. 4. *S. trinodosa.*

Last whorl costated. 5. *S. radiata.*

SPECIES UNFIGURED.

S. sufflata, *Tenison Woods* (Cassis), Proc. Roy. Soc., Tasmania, for 1867, p. 21 (1879). Table Cape.

Digitized by Google

1. Semicassis transenna, *spec. nov.* Plate viii., fig. 2.

Shell thin, ovate, ventricose, contracted at the base; spire moderately produced, broadly conical, ending in a very small pullus of two and a half smooth, narrow, convex whorls.

Whorls four, excluding the pullus, subangulated in the posterior-third, slightly margined in front of the suture, with raised spiral threads cancellated by fine transverse equidistant threads. The spiral threads are about twelve on the penultimate whorl, the one on the angulation being the most prominent, those on the posterior slope (about five or six) being more slender than the anterior ones. The canoellation is obscure on the median portion of the last whorl, and the base is spirally flatly ridged only.

Aperture oval-oblong, obtuse behind, rounded in front; outer lip thickened, hardly ascending on the penultimate whorl; margin plain or obscurely dentately ridged. Columella-expansion erect, smooth; pillar twisted with a few slender oblique plaits.

Dimensions.—Length, 28; breadth, 17; length of aperture, 19.

Localities.—Lower beds at Muddy Creek; blue clays at Schnapper Point; calciferous sandstones, River Murray Cliffs near Morgan *(R. T.)*; Table Cape *(R. M. Johnston!)*.

This highly sculptured shell has no analogue in living creation; it is very common at Muddy Creek, and exhibits very slight variability.

2. Semicassis subgranosa, *spec. nov.* Plate vii., fig. 10.

Shell ovate, somewhat contracted at the base; spire acuminate, moderately elevated, ending in a conical pullus of three smooth convex whorls.

Whorls four, excluding pullus, moderately convex, margined at the anterior suture and bounded by an ante-sutural, concavely depressed, narrow zone. The first whorl finely lirate; the second and third encircled with about seven rows of granules which are on slightly oblique transverse folds; penultimate whorl with close-set oblique rounded costæ which are cut into granulose-crenatures by seven or eight encircling sulci.

Last whorl somewhat ventricose, sculptured with oblique costæ, which fade away at less than half way to the base, and encircling sulci which produce granulose-crenatures on the costæ, more conspicuously so on the first two costæ anterior to the sutural depression; the marginal band obscurely granulose. Aperture concealed in the only known specimen.

Dimensions.—Length, 55; breadth, 34; length of aperture, 37.

Locality.—Hard raggy-limestones, Edithburgh, Yorke's Peninsula.

This species has the shape of *S. semigranosa*, but differs by the

Digitized by Google

greater development of costæ and the less defined granular ornament, and by the last whorl being conspicuously spirally sulcated throughout.

3. Semicassis Muelleri, *spec. nov,* Plate vii., fig. 9.

Shell rather thin, globosely inflated; spire short, ending in a small pullus of one and a half, smooth, slightly swollen whorls.

Whorls four, excepting pullus, separated by an impressed suture, roundly angled medially, spirally ribbed; the posterior whorls with about four spiral ribs, tessellated by transverse threads; penultimate whorl with a stout medial ridge, two behind, one at the posterior suture, and two or three in front. The ribs are rounded, unequally disposed, incised by rather distant obliqne threads.

Last whorl ventricose, with a round shoulder, posterior to which are five spiral ribs, the medial one the strongest, the posterior one margining the suture; the ribs are crossed by sharp threads which crenulate them, but on the middle of the whorl are obsolete or continued as striæ; base with a few encircling depressed ribs.

Aperture ovately lunate; outer lip plain, reflected; columella nearly straight, medially thickened, twisted and obliquely truncated at the end, with about ten slender revolving plaits, expanded over the umbilical region.

Dimensions.—Length, 25; breadth, 20; length of aperture, 18.

Locality.—Upper beds at Muddy Creek.

This species, which resembles in miniature *S. nivea,* Brazier, but has a different ornament, is dedicated to Baron Sir F. von Mueller as a public mark of recognition of his contributions to the phytology of the Australian Tertiary Period.

4. Semicassis trinodosa, *spec. nov.* Ptate vii., fig. 12.

Shell globosely ovate, spire short, acuminate, ending in a small conical pullus of three smooth convex whorls.

Whorls four, excluding pullus, convex, with depressed spiral ridges and narrower sulci.

Last whorl ventricose, contracted at the base, sculptured with flatly rounded spiral ridges, and ornamented with three rows of tubercles, one on the rounded shoulder of the whorl, the third at about half way to the front, the second about midway between. The tubercles on the posterior row are the largest, smaller in size on the medial row, and somewhat inconspicuous on the anterior row.

Aperture lunate; outer lip very much thickened and slightly reflexed, ascending to the middle of penultimate whorl; margin smooth, except a few obscure denticles at the front; columella somewhat patulous, smooth, dentately ridged on the margin.

Digitized by Google

Dimensions.—Length, 30; breadth, 21; length of aperture, 25.
Locality.—Bairnsdale, Gippsland *(W. H. Gregson!)*.

This fossil shell has the shape of *S. abbreviata*, Lamarck, recent on the west coast of Tropical America, from which it differs by the three subdistant rows of tubercles and its smooth inner lip.

5. Semicassis radiata, *spec nov.* **Plate viii., fig. 3.**

Shell globosely ovate, spire of moderate length, acuminate, ending in a small pullus of one and a half smooth convex whorls.

Whorls four, excluding pullus, convex, but interrupted by a broadish concave depression in front of the marginal rib at the anterior suture.

Posterior whorls ornamented by straight, rather crowded, slender costæ, which terminate behind at the ante-sutural depression.

Last whorl ventricose, contracted at the base, and concavely depressed in front of the suture, from which it is separated by a nodosely-crenulated band; ante-sutural zone with three or four spiral threads. Median portion ornamented with angular, slightly elevated, moderately curved costæ (about 24); at first slender and crowded, but become stronger and more widely separated with the revolution of the whorl, and are absent in the last-fourth. The costæ are interrupted on the shoulder by three inconspicuous angulations; otherwise the surface anterior to the sutural zone is without spiral ornament, except some obscure lines at the base.

Aperture ovate; outer lip thickened, margin plain, slightly ascending on the penultimate whorl. Columella convex, its surface without granulations, with fine slender revolving plaits; a small tubercle at the posterior angle of the aperture.

Dimensions.—Length, 23; breadth, 15; length of aperture, 18.
Locality.—In a well sinking, Murray Desert.

This species approaches the nodulate variety of *S. torquata*, Reeve, recent in temperate waters of Australia; but it differs by its finer ornamentation, more developed costæ, shorter spire, more tumid body whorl, by the presence of slender threads on the ante-sutural band, and by its smooth outer lip.

Genus Cassidaria.

Synopsis of species.

Whorls sharply gradated, unequally and distantly lirate; keels on body whorl with crenate tubercles. 1. *C. gradata.*
Whorls angular, regularly lirate; keels on body whorl with transverse tubercles; less ventricose. 2. *C. Wilsoni.*

Digitized by Google

1. Cassidaria gradata, *spec. nov.* Plate viii., fig. 1.

Shell thin, shining, pyramidally ovate, with a moderately elongated scalar spire, ending in a small subacute pullus of one and a half turns. Ordinary whorls five; first whorl slightly convex, lirate; the succeeding whorls rapidly increasing to the sharply gradated outline of the penultimate whorl. The angulation is medial, and cut into sharp serratures, which terminate oblique obscure ridges proceeding from the suture; surface sculptured with raised truncate threads, inequidistant and unequal, separated by broad flat interspaces, from three to five above and below the serrated keel; the threads rendered obscurely granulose-crenate by transverse growth lines.

Some specimens show an angular spiral ridge at the anterior suture, but is variable in the degree of its development.

Last whorl with from four to five spiral keels on the median portion; the posterior one, at the angulation, with angular nodulations (about 20), the others are angular or somewhat truncated, and bear sharp tubercles, diminishing in size towards the front; interspaces concavely depressed with a few spiral threads and transverse distant striæ.

Base of whorl with spiral ridges; canal long, nearly closed, abruptly bent and reverted.

Aperture oblong; outer lip thickened with two or three elongate denticles at the front; inner lip corrugated.

Dimensions.—Length, 40; breadth, 30; length of aperture to the canal, 25.

Localities.—Lower beds at Muddy Creek; calciferous-sandstones, River Murray Cliffs; blue clays at Schnapper Point.

2 Cassidaria Wilsoni, *spec. nov.* Plate vii., fig. 14.

Whorls sub-gradated, margined at the suture; medially angular, cancellated. Last whorl with four obtuse ridges, bearing small transversely elongated tubercles (about 30), becoming increasingly inconspicuous anteriorly; whole surface sculptured with fine equi-distant spiral threads and regular growth lines, the posterior slope being neatly and conspicuously fenestrated.

Dimensions.—Length, 27; breadth, 17; length of aperture to canal, 19.

Locality.—Spring Creek, near Geelong *(J. B. Wilson!).*

FAMILY STROMBIDÆ.

Genus Struthiolaria.

1. Struthiolaria lirata, *spec. nov.* Plate x., fig. 11.

Shell turbinately oval, sub-globose; whorls four and a half, those of the spire moderately convex; ornamented by strong, equi-distant, depressed liræ, becoming more slender posteriorly;

Digitized by Google

a little narrower than the flat intervening sulci; liræ about ten to twelve on the penultimate whorl.

Last whorl sub-quadrately rounded, shortly and broadly attenuated at the base; equi-distantly lirate, with a thread and a few striæ in the interstitial spaces, obscurely marked with sigmoidal transverse striæ.

Aperture quadrately oval; outer lip much thickened; siphonal notch very short and narrow, not interrupting the outer rim of the lip.

Dimensions.—Length, 15·5; breadth, 12; length of aperture, 9.

Locality.—Jemmy's Point, Gippsland Lakes *(W. H. Gregson !)*

The well-rounded whorls, not sulcated at the suture, and the simple lirate sculpture distinguish this species from all known congeneric forms either recent or fossil; this is the first record of the genus as a constituent of the Cainozoic fauna of Australia.

Genus Pelicaria.

Of this genus, allied to *Struthiolaria*, having its head-quarters in the seas of New Zealand, only two species are known, namely, *P. scutulata* (Martyn), which inhabits the coast of New South Wales, and *S. mirabilis* (Smith), of the Kerguelen Islands. *Pelicaria* differs from *Struthiolaria*, chiefly in the enamel-covered spire of the adult shell, and the thin sinuous outer lip. The two fossil species, now to be described, do not differ in any striking manner from *P. scutulata*, but both are less turreted.

Synopsis of species.

Spire whorls roundly angled, with clathrate ornament.
1. *P. clathrata.*

Spire whorls angled and nodulose; sulcate at suture.
2. *P. coronata.*

Pelicaria clathrata, *Tate.* Plate x., fig. 9.

Reference.—Southern Science Record, January, 1885, p. 2.

Shell ovate, spire acuminated, whorls six convex, suture linear or slightly impressed. Surface ornamented with numerous lamelliform rugæ, becoming confluent by twos and threes or more at the anterior-third to form ridges, and by spiral threads abont ten in number. Last whorl quadrate, depressed in the medial part, with a row of small acute nodulations at the shoulder, and a thickened ridge at the periphery; ornamented with sigmoidal lamelliform rugæ and lines of growth which are cancellated by numerous longitudinal ridges. Callus-enamel spreading over the columella and body-whorl for two-thirds of its length and over-lapping on the penultimate whorl.

Digitized by Google

Dimensions.—Length and breadth of shell, 28 and 22, of aperture, 16 and 8.

Locality.—Bairnsdale, Gippsland *(W. H. Gregson!)*.

Pelicaria coronata, *Tate.* Plate x., figs. 6 and 13.

Reference.—Southern Science Record, January, 1885, p. 2.

Shell ovate, spire acute, whorls eight, angled, suture chanelled. Surface ornamented with transverse striæ and spiral ridges, and a row of small nodulations on the angle of the whorl. Last whorl sub-quadrate, slightly depressed in the middle line; angle without nodulations and separated from the suture by a broad and deep groove. Callus-enamel spreading over the whole of the body-whorl and the anterior-half of the penultimate whorl.

Dimensions.—Length and breadth of shell, 45 and 32; of aperture 23 and 14.

Localities.—Upper beds at Muddy Creek *(J. Dennant)*; Gippsland beds at Cunninghame, Jemmy's Point, and Reeve's River *(W. H. Gregson!)*; well-sinking, Murrray Desert *(R. T.)*.

Of the two fossil species, *P. coronata* makes the nearest approach to *P. scutulata*, but it has a shorter spire, nodulate rather than crenate on the keel, whilst the canaliculate suture of the body-whorl is very distinctive.

EXPLANATION OF PLATES II. TO X.

N.B.—The figures are of the natural size, except when otherwise stated.

PLATE II.

1. Voluta sarissa, *Tate.* Muddy Creek. *a.* Perfect shell; *b*, apex enlarged.
2. Voluta McCoyii, *Woods.* Muddy Creek.
3. Voluta capitata, *Tate.* Murray Desert. *a*, Dorsal aspect of entire shell; *b*, apex enlarged.
4. Voluta lirata, *Johnston.* Muddy Creek.
5. Voluta Tateana, *Johnston.* Table Cape.
6. Voluta protcrhysa, *Tate.* Adelaide. *a*, Ventral aspect of mature shell; *b*, posterior portion of spire enlarged.
7. Voluta polita, *Tate.* Muddy Creek. Slightly enlarged.
8. Voluta costellifera, *Tate.* Muddy Creek.

PLATE III.

1. Voluta lintea, *Tate.* River Murray Cliffs. *a*, Slightly enlarged; *b*, magnified view of ornament.
2. Voluta crassilabrum, *Tate.* Muddy Creek. *a* and *b*, Dorsal and ventral aspects slightly enlarged; *c*, magnified view of ornament.
3. Mitra Dennanti, *Tate.* Muddy Creek.
4. Lyria gemmata, *Tate.* Muddy Creek. Very slightly enlarged.

Digitized by Google

5. Voluta McDonaldi, *Tate*. Muddy Creek. An adult shell slightly reduced.
6. Fusus Gippslandicus, *Tate*. Bairnsdale.
7. Voluta ancilloides, *Tate*. Schnapper Point.
8. Voluta cribrosa, *Tate*. Aldinga.
9. Voluta Masoni, *Tate*. Muddy Creek.

Plate IV.

1. Voluta heptagonalis, *Tate*. River Murray Cliffs. Apical portion of spire.
2. Nassa sublirella, *Tate*. Muddy Creek. Enlarged.
3. Eburnopsis aulaccessa, *Tate*. Muddy Creek. Enlarged.
4. Peristernia Murrayana, *Tate*. River Murray Cliffs. Very slightly enlarged.
5. Phos Gregsoni, *Tate*. Gippsland. Enlarged.
6. Mitra atypha, *Tate*. Muddy Creek. Enlarged.
7. Voluta heptagonalis, *Tate*. Reduced to two-thirds.
8. Mitra alokiza, *Woods*. Muddy Creek.
9. Mitra dictua, *Woods*. Murray Desert.
10. Mitra othone, *Woods*. Muddy Creek. Enlarged.
11. Mitra atractoides, *Tate*. Muddy Creek. Enlarged.
12. Mitra uniplica, *Tate*. Schnapper Point.

Plate V.

1. Mitra varicosa, *Tate*. Adelaide. Slightly enlarged.
2. Mitra paucicostata, *Tate*. Muddy Creek. Enlarged.
3. Mitra leptalea, *Tate*. Muddy Creek. Enlarged.
4. Mitra ligata, *Tate*. Schnapper Point. Much enlarged.
5. Mitra terebræformis, *Tate*. Muddy Creek. Enlarged.
6. Mitra subcrenularis, *Tate*. Adelaide. Enlarged.
7. Voluta alticostata, *Tate* Muddy Creek.
8. Mitra escharoides, *Tate*. Muddy Creek. *a*, Enlarged; *b*, sculpture much enlarged.
9. Mitra semilævis, *Tate*. Muddy Creek. Much enlarged.
10. Mitra biornata, *Tate*. Muddy Creek. Enlarged.
11. Mitra citharelloides, *Tate*. Aldinga. Enlarged.
12. Mitra complanata, *Tate*. Adelaide. Enlarged.
13. Mitra euglypha, *Tate*. Gippsland. Enlarged.

Plate VI.

1. Harpa tenuis, *Tate*. Muddy Creek.
2. Harpa lamellifera, *Tate*. Muddy Creek.
3. Harpa spirata, *Tate*. Schnapper Point.
4. Harpa cassinoides, *Tate*. Murrray Desert.
5. Mitra cassida, *Tate*. Muddy Creek. Enlarged.
6. Mitra sordida, *Tate*. Muddy Creek. Enlarged.
7. Harpa abbreviata, *Tate*. Muddy Creek.
8. Harpa clathrata, *Tate*. River Murray Cliffs.
9. Harpa pulligera, *Tate*. Schnapper Point.
10. Harpa sulcosa, *Tate*. Muddy Creek. Slightly enlarged.
11. Fusus henicus, *Tate*. Muddy Creek. Slightly enlarged.
12. Fasciolaria fusilla, *Tate*. Muddy Creek.
13. Ancillaria pseud-australis, *Tate*. Senile example. Murray Desert.

Plate VII.

1. Ancillaria pseud-australis, *Tate*. Muddy Creek.
2. Ancillaria lanceolata, *Tate*. Muddy Creek.
3. Ancillaria subampliata, *Tate*. Muddy Creek.

Digitized by Google

4. Ancillaria papillata, *Tate.* Muddy Creek.
5. Ancillaria hebera, *Hutton.* River Murray Cliffs.
6. Ancillaria ligata, *Tate.* Adelaide.
7. Oliva nymphalis, *Tate.* Gippsland.
8. Ancillaria subgradata, *Tate.* Adelaide.
9. Semicassis Muelleri, *Tate.* Muddy Creek.
10. Semicassis subgranosa, *Tate.* Edithburg.
11. Cassis textilis, *Tate.* River Murray Cliffs.
12. Semicassis trinodosa, *Tate.* Gippsland.
13. Cassis exigua, *Woods.* Muddy Creek.
14. Cassidaria Wilsoni, *Tate.* Spring Creek.

Plate VIII.

1. Cassidaria gradata, *Tate.* Schnapper Point.
2. Semicassis transenna, *Tate.* Muddy Creek.
3. Semicassis radiata, *Tate.* Murray Desert.
4. Peristernia pumila, *Tate.* Adelaide. Much enlarged.
5. Mitra exilis, *Tate.* Muddy Creek. Much enlarged.
6. Oliva Adelaidensis, *Tate.* Adelaide. Enlarged.
7. Oliva angustata, *Tate.* Muddy Creek. *a*, Natural size; *b*, apex much enlarged.
8. Mitra clathurella, *Tate.* Muddy Creek. Much enlarged.
9. Cancellaria epidromiformis, *Tate.* Muddy Creek. Enlarged.
10. Cancellaria exaltata, *Tate.* Schnapper Point. Enlarged.
11. Cancellaria Wannonensis, *Tate.* Muddy Creek.
12. Terebra platyspira, *Tate.* Muddy Creek.
13. Terebra angulosa, *Tate.* Murray Desert.
14. Terebra catenifera, *Tate.* Muddy Creek. Enlarged about one and a half diameters.
15. Terebra leptospira, *Tate.* Muddy Creek. *a*, Enlarged about two diameters; *b*, apex very much enlarged.

Plate IX.

1. Voluta Mortoni, *Tate.* Young shell. Table Cape.
2. Voluta Mortoni, *Tate.* Fragment of adult; half natural size. Muddy Creek.
3. Cancellaria calvulata, *Tate.* Schnapper Point. Enlarged about two diameters.
4. Cancellaria modestina, *Tate.* Muddy Creek. Enlarged nearly three diameters.
5. Cancellaria ptychotropis, *Tate.* Aldinga. Enlarged about four diameters.
6. Cancellaria Etheridgei, *Johnston.* Table Cape. Enlarged about five diameters.
7. Cancellaria caperata, *Tate.* Schnapper Point. Enlarged about six diameters.
8. Terebra geniculata, *Tate.* Muddy Creek. Enlarged about four diameters.
9. Terebra crassa, *Tate.* Aldinga. Enlarged about two diameters.
10. Terebra mitrellæformis, *Tate.* Aldinga. Enlarged about three diameters.
11. Terebra subspectabilis, *Tate.* Muddy Creek. Enlarged about two diameters.

Plate X.

1. Terebra mutica, *Tate.* Muddy Creek. Enlarged about four diameters.
2. Mitra conoidalis, *Tate.* Muddy Creek. *a* and *b*, Dorsal and ventral aspects. Enlarged about three diameters.
3. Cancellaria semicostata, *Tate.* Muddy Creek. Enlarged about six diameters.

Digitized by Google

4. Terebra convexiuscula, *Tate.* Muddy Creek. Enlarged four diameters.
5. Ancillaria orycta, *Tate.* Gippsland. Slightly enlarged.
6. Pelicaria coronata, *Tate.* Muddy Creek. Ventral aspect.
7. Cancellaria? alveolata, *Tate.* Muddy Creek. Enlarged about four diameters.
8. Cancellaria micra, *Tate.* Adelaide-bore. Enlarged about five diameters.
9. Pelicaria clathrata, *Tate.* Gippsland.
10. Cancellaria capillata, *Tate.* Muddy Creek. Enlarged about three diameters.
11. Struthiolaria lirata, *Tate.* Gippsland. Enlarged about two diameters.
12. Cancellaria gradata, *Tate.* Muddy Creek. Enlarged two diameters.
13. Pelicaria coronata, *Tate.* Dorsal aspect. Muddy Creek.
14. Cancellaria turriculata, *Tate.* Aldinga. Enlarged about five diameters.

Digitized by Google

Further Notes on Australian Coleoptera, with Descriptions of New Species.

By the Rev. T. Blackburn, B.A.

[Read October 2nd, 1888.]

The following paper embodies the results of some studies I have recently made among the *Phytophaga* of the sub-tribe *Galerucidæ*, and among the *Coccinellidæ* of the group called by M. Mulsant "Trichosomides."

GALERUCIDÆ.

Up to the present time, so far as I can ascertain, only one species of this sub-tribe has been actually recorded as occurring in the colony of South Australia (outside the Northern Territory), and that species (*Monolepta croceicollis*, Germ.) I do not think that I have seen. A second species (*Ellopia pedestris*, Er.) is attributed by Mr. Masters in general terms to "Australia and Tasmania," by which I suppose it is intended to imply that its range is a wide one. I have frequently met with it as far west as the Port Lincoln district, where in some localities it is rather plentiful. In the following pages I describe seven new species from South Australia proper, two from the Northern Territory, five from Western Australia, and one from New South Wales. I have been compelled to supply a new generic name for one of the South Australian species. The *Galerucidæ* appear to be much more plentiful in the northern than in the southern parts of the continent.

AGELASTICA.

Although widely different in colours and markings from any other *Agelastici* known to me, the following insect does not appear to display structural characters that call for generic distinction. It has the anterior coxal cavities open behind, the prolonged epipleuræ, the appendiculated claws, the basal joint of the hind tibiæ not longer than the following two joints together, the mucronated tibiæ, &c., as in *Agelastica;* the antennæ, however, are more slender and the prothorax less transverse than is usual in the genus.

A. lineata, sp. nov. Oblonga; supra livida, capite nigro-maculato, prothorace elytrisque lineatim nigro-notatis; subtus nigro-picea, metasterno prosterno palpis et pedibus (femoribus

Digitized by Google

piceo notatis exceptis) testaceo-lividis; antennis piceis, articulis singulis (basali exceptâ) basi testaceis. Long. $2\frac{3}{5}$ l.; lat., $1\frac{1}{5}$ l. (vix).

The head is entirely testaceous in front of the antennæ, the hinder part being clouded with black so as to leave only a spot above each eye testaceous. On the prothorax the dark marking takes the form of an irregular and interrupted M. On the elytra the suture is narrowly blackish, and there are also on each elytron four more or less interrupted vittæ wider than the sutural one. None of these dark markings extend into the apical sixth part of the elytra; probably they are variable. In my example the vitta next to the suture is very much interrupted, the anterior part of the third vitta is wanting, and the hinder part of the same runs into the hinder part of the fourth. The head is finely rugulose in front, almost lævigate behind. The antennæ are about two-thirds the length of the body, and only moderately stout, much less so than in *A. melanocephala*, Baly.; joint 1 long piriform black, 2 less than half 1, 3 about twice 2, 4 and the following joints a little longer than 3. The prothorax is about a quarter again as wide as long, slightly narrowed in front, the sides gently arched, the reflexed border rather strong, the front margin truncate or even a little convex, the base widely produced hindward behind the hind angles, the reflexed margin dilated at the front and hind angles, the former being obtuse, the latter right; the surface rather finely and not closely punctulate, more coarsely towards the sides. The elytra are punctured about as closely as the disc of the prothorax, and scarcely so finely, having also some much finer punctures intermingled. The apex of each femur is blackish.

Taken in Western Australia by E. Meyrick, Esq.

MORPHOSPHÆRA.

It is with considerable hesitation that I refer the following species to this Malayan genus; it ought probably to form a new genus, but as there are several already named genera of *Galerucidæ* of which I have been unable to procure descriptions, I think it better to refer the insect to an existing genus than run the risk of increasing synonymy. The examples before me agree with *Morphosphæra Sumatrana*, Jac., in having the anterior coxal cavities open behind, the antennæ short and robust, the elytral epipleuræ obsolete (or very narrow and vertical) behind the middle, the tibiæ with a short apical spine, and the claws appendiculate. The basal joint of the hind tarsi is a little longer than the following two together, but shorter than the following three. It has much the facies of a very small *Adimonia*, but with the antennæ more, and the legs somewhat less, robust It should be

Digitized by Google

added that *M. Sumatrana*, Jac., differs in important respects from *M. maculicollis*, Baly, on which the genus was founded.

M. (?) cincta, sp. nov. Oblonga; sat robusta; sat nitida; fulva; antennis (articulo 1° basi excepto), palpis, et metasterno, nigris; tibiis intermediis posticisque, tarsis omnibus, et abdomine postice, infuscatis vel piceis; elytris marginibus omnibus cyaneo-nigris; capite prothoraceque subtiliter crebre, elytris minus subtiliter sat crebre, punctulatis. Long., 1⅝ l.; lat., ⅝ l. (vix.)

The blue-black edging of each elytron is wider along the base and suture than on the lateral margins. The infuscation of the posterior 4 tibiæ begins a little above the middle. The antennæ are very little more than half the length of the body, robust, the first and fourth joints each equal to the other and to the second and third together, the third rather longer than the second. The head bears a very strong somewhat arched transverse furrow between the eyes. The prothorax is very little wider than long, its front angles but feebly defined, its hind angles dentiform; it bears an extremely strong, round fovea on either side of the disc, and these are feebly connected by a shallow transverse impression.

Western Australia; sent to me by E. Meyrick, Esq.

NEORUPILIA, *gen. nov.*

Caput sat magnum; antennæ graciles corpore vix breviores; articulo 1° elongato, 2° 1° triplo breviori, 3° 2° duplo longiori, 4° 3° longitudine æquali; acetabula antica postice aperta; epipleuræ distinctæ postice obsoletæ; tibiæ mucronatæ; unguiculi leviter appendiculati, parvi; metasternum breve; elytra abdomen haud tegentia.

The metasternum not longer than the prosternum and the elytra separately rounded (or almost subtruncate obliquely) at the apex leaving the last segment and part of the penultimate exposed in one sex (in what I take to be the other sex not quite covering the antepenultimate segment) associate this insect with the group *Rupiliites* of Dr. Chapuis, but it is not closely allied structurally to any of the previously described genera of that group. The claws are very small, and seem to be slightly appendiculate; they are certainly not bifid as in all the known *Rupiliites* except *Marseulia* in which they are simple; perhaps they would be best described as obtusely dentate near the base.

N. viridis, sp. nov. Oblonga; minus robusta; sat nitida; nigra, supra subaureo-viridis; antennis basi, genubus, tibiis, et tarsis (apice excepto), testaceis; capite prothoraceque sparsim subtilissime, elytris sat crebre sat crasse subsquamose, punctulatis. Long., 1 l; lat., ½ l.

Digitized by Google

The head bears a transverse furrow between the eyes and a longitudinal carina between the antennæ. The prothorax is not much wider than long, almost truncate in front where it is a little wider than at the base, the sides moderately arched, the front angles obscure, the hind angles subdentiform. The basal joint of the antennæ is pitchy (testaceous beneath), the second and third are dull testaceous, the rest pitchy black.

The single example which I take to be the other sex of this species, in addition to having much shorter elytra, has the antennæ more slender, and the parts of the legs and antennæ which in the type are testaceous, are much more obscure. It may possibly appertain to a distinct species.

Port Lincoln.

ELLOPIA.

E. Sloanei, sp. nov. Sat elongata, postice dilatata; subnitida; supra glabra, piceo-lurida, subcupreo-tincta; capite antice, prothoracis marginibus, tibiisque basi, dilutioribus; corpore subtus nigro; hoc cum pedibus pubescenti; coxis testaceis; capite prothoraceque leviter minus subtiliter punctulatis; elytris coriaceis vix perspicue punctulatis, singulis longitudinaliter profunde bisulcatis. Long., $3\frac{3}{5}$ l; lat., $1\frac{4}{5}$ l.

This remarkable species agrees perfectly with *Ellopia pedestris*, Er., (which appears to be widely distributed in South Australia) in all structural characters, but is widely different specifically. The two deep furrows abbreviated at both ends running down the inner half of each elytron are a very distinctive character; in some (perhaps most) examples there are traces of a much feebler sulcus at no great distance from the lateral margin. The antennæ are a little less robust than in *E. pedestris*; in some examples (as appears also the case in *E. pedestris*) the second joint is less abbreviated than in others; I believe this to be sexual and that the second joint is elongated in the females.

Mulwala (N.S.W.); taken by Mr. T. G. Sloane and courteously supplied to me.

CANDEZEA.

C. Palmerstoni, spec. nov. Sat late oblonga; sat nitida; nigra; capite (labro, palpis, et antennis apicem versus exceptis), prothorace et elytris, testaceis; pedibus plus minus piceseentibus; capite prothoraceque subtilissime sat sparsim, elytris minus subtiliter minus sparsim, punctulatis. Long, $2\frac{4}{5}$. l; lat., $1\frac{2}{5}$ l.

The elytra in some examples are vaguely clouded with infuscation in the hinder half. Head with a straight transverse furrow between the eyes. Antennæ about half as long as the body,

Digitized by Google

rather slender, the basal three joints testaceous, the rest dark piceous or black, joints 1 and 4 about equal to each other, and each about equal to 2 and 3 together, 3 longer than 2. Prothorax scarcely half as wide as the greatest width of the elytra, about half again as wide as long, moderately narrowed to the front, its angles a little thickened (the anterior nearly right, the posterior obtuse), narrowed and widely produced hindward behind the hind angles, the front almost truncate. Elytral epipleuræ very well defined almost to the apex. Basal joint of hind tarsi longer than the following three together. Claws appendiculate. All the tibia mucronate. Anterior coxal cavities closed.

I think there is no doubt of the correctness of the reference of this species to *Candezea* (not previously recorded as Australian); at any rate this species and the following appear to be congeneric with *C. bimaculata*, Jac., from New Guinea, which their author attributes to the genus.

Northern Territory of South Australia; taken by Dr. Bovill.

C. Bovilli, sp. nov. Sat late oblonga; sat nitida; testacea; antennis (basi exceptis) piceis; elytris (humeris exceptis) fulvo piceis; capite prothoraceque subtiliter sat crebre, elytris sat fortiter sat crebre, punctulatis. Long., $2\frac{4}{5}$ l.; lat., $1\frac{3}{5}$ l.

Each shoulder is testaceous on an area about as large as one of the eyes, and the testaceous colour is narrowly continued thence to the scutellum along the base; the suture also is vaguely stained with testaceous near the base (probably the colour of the elytra is variable). The antennæ and head scarcely differ from those of *C. Palmerstoni*, except in the latter being a little narrower; the prothorax too resembles that of the same species, but is much more closely and strongly punctulate, with the angles more defined and thickened; the puncturation of the elytra too is much stronger. There is a vague depression on either side of the disc of the prothorax.

Northern Territory of South Australia; a single specimen taken by Dr. Bovill.

MONOLEPTA.

M. angulata, sp. nov. Oblonga; sat nitida; piceo-nigra; antennarum basi, ore, capite subtus postice, prosterno medio, pedibusque testaceis; capite supra postice, prothorace basi, scutello et elytris gutta humerali fasciaque angulata ante medium, flavo-rufis; capite sparsim subtilissime, prothorace subtiliter minus sparsim, elytris fortius minus sparsim, punctulatis. Long., $1\frac{4}{5}$ l.; lat. $\frac{4}{5}$ l.

A furrow runs across the head between the eyes, curving for-

Digitized by Google

ward. The prothorax is half again as wide as long, its front almost truncate, its front angles feeble, its sides gently arched, its hind angles sub-dentiform, its surface even. The antennæ are about two-thirds the length of the body, moderately slender, the basal three joints testaceous, joints 1 and 4 about equal to each other, and each about equal to 2 and 3 together, the latter two not differing much from each other in length. The epipleuræ of the elytra though very narrow and obscure behind the middle do not appear to be absolutely non-existent. The tibiæ are finely mucronated, the anterior coxal cavities closed. The claws are appendiculated. The basal joint of the hind tibiæ equals in length the following three together.

Port Lincoln; not uncommon.

M. fasciatipennis, sp. nov. Oblonga; sat nitida; testacea; antennis (basi apiceque exceptis) femoribus basi et (nonnullis exemplis) tibiis, infuscatis vel piceis; prothorace antice (nonnullis exemplis) et elytris totis (fascia angulata mediana excepta), nigris; capite sparsim subtiliter, prothorace elytrisque minus sparsim minus subtiliter, punctulatis. Long., $1\frac{4}{5}$ l.; lat., $\frac{4}{5}$ l.

The puncturation is in general a little less strong and less sparing; apart from this difference and its very different pattern and arrangement of colors, the present species scarcely differs from the preceding. Regarding the ground color of the elytra as black, the red fascia is much wider and less conspicuously angulated than that of *M. angulata;* this fascia is so placed that its hind margin is slightly behind the middle of the elytra. I can find no structural distinction except that the epipleuræ are even more obscure behind the middle, but still not entirely wanting; if carefuliy examined under a powerful lens the elytra are seen to end laterally in (not a single sharp edge like that of a knife blade but) two very fine edges parallel to, and apparently in contact with, each other.

Interior of South Austrslia; basin of Lake Eyre.

M. divisa, sp. nov. Oblonga; sat nitida; testacea; antennis (basi excepta), palpis, elytris parte dimidia apicali, et abdomine, piceis vel nigris; tarsis supra plus minus infuscatis; capite prothoraceque vix perspicue, elytris subtilius minus crebre, punctulatis. Long., $1\frac{3}{5}$ l.; lat., $\frac{7}{10}$ l.

The sculpture and proportions of the several parts do not seem to differ noticeably from the same in *M. angulata*, except as follows, viz.: The prothorax is punctured only very obscurely, and for the most part only near the margins, and it has an ill-defined transverse depression (in some examples interrupted near the middle) across the disc; the elytra are punctured much more finely

Digitized by Google

and more confusedly (*i.e.*, with punctures still smaller scattered among the prevalent punctures); and the epipleuræ are still less distinct, the two fine lines (that in the hind half of the elytra represent what in front are the two margins of the epipleuræ) both running close before the lateral edge of the upper surface of the elytra; thus the epipleuræ in the hinder part are vertical and excessively narrow, and if they be sought by looking down upon the *under surface* of the insect they cannot be seen at all.

Sedan (South Australia); taken by Mr. B. S Rothe.

M. inconspicua, sp. nov. Oblonga; sat nitida; fusca, subtus obscurior, antennis apicem versus picescentibus: capite vix perspicue, prothorace subtilius sat sparsim, elytris crassius sat leviter sat crebre, punctulatis. Long., $1\frac{2}{5}$ l.; lat., $\frac{3}{5}$ l.

Compared with *M. angulata*, the antennæ are evidently shorter and the prothorax is more transverse (about twice as wide as long), with the posterior angles less dentiform. The puncturation is not much different from that of *M. angulata*, but seems to be a little less strongly impressed. The epipleuræ are like those of *M. divisa*. The other structural characters seemed to be identical with those of the preceding three species.

An example with long slender antennæ (not much shorter than the body) of which the 3rd joint is evidently longer than the 2nd, may perhaps be the other sex of this insect.

Port Lincoln.

M. Meyricki, sp. nov. Oblongo-ovatus; niger, prothorace, femoribus, tibiis (his apice excepto), et antennarum articulis basalibus 3 (parte apicali picea excepta), testaceis; elytris nigrocyaneis; his crebre minus fortiter rugulose punctulatis; subtus parce pubescens; epipleuris mox pone medium obsoletis. Long., $2\frac{2}{5}$ l.; lat., $1\frac{1}{5}$ l.

A well-marked curved furrow runs across from eye to eye on the head, which is longitudinally carinate down the middle of the anterior portion, and is scarcely distinctly punctulate in any part. The antennæ are about three-quarters the length of the body. The prothorax is in outline and puncturation scarcely different from that of *Agelastica lineata*, except in being slightly more transverse; it differs in the absence of markings and in the presence across the centre of an ill-defined but wide and deep transverse furrow, which is almost interrupted at its middle. The puncturation of the elytra is rugulose, rather strong, and very close.

A single specimen was sent to me from Western Australia by E. Meyrick, Esq.

Digitized by Google

M. occidentalis, sp. nov. Oblongo-ovatus; niger, capite (vertice summo excepto), prothorace, antennarum basi, pedibusque testaceis; elytris viridibus; his subtiliter minus crebre haud rugulose punctulatis; subtus parce pubescens; epipleuris apicem fere attingentibus. Long., $2\frac{1}{8}$ l.; lat. 1 l.

The sculpture of the head does not differ noticeably from the same in *M. Meyricki*, and the antennæ scarcely differ except in having the basal three joints testaceous and the fourth fuscous. The prothorax is nearly twice as wide as long, and has the angles less prominent and thickened than in *M. Meyricki*, but otherwise is very similar. The puncturation of the elytra is much less close and a little less strong than in that insect.

Western Australia; taken by E. Meyrick, Esq.

M. modesta, sp. nov. Oblonga; capite abdomineque nigris, prothorace pedibusque rufo-testaceis, elytris viridi-nigris, antennis palpisque fuscis; elytris sat crasse sat crebre squamose punctulatis; subtus parce pubescens; epipleuris apicem versus anguste continuatis. Long., $1\frac{3}{8}$ l.; lat., $\frac{3}{8}$ l.

Var. Corpus plus minus obscurum fere usque ad totum nigrum.

As regards colour, I have seldom seen a more variable species than this; all the parts that are not black or greenish-black in the type appear liable to be so exceptionally, except the tibiæ (which are more or less testaceous in all the examples I have seen) and the tarsi, which do not seem to get beyond dark brown. The head does not differ notably from that of *M. occidentalis*, except in having the furrow between the eyes angulated in the middle; the prothorax, too, is similar in proportions and outline, except that its front margin is equal to (not as in *M. occidentalis* a little narrower than) the base; it is, however, much more sparingly punctured, and has no transverse depression across the middle. The elytra are rather coarsely and squamosely, but not closely, punctured; compared with those of *Luperus flavipes*, Linn. (which this insect somewhat resembles), they are more coarsely and squamosely punctulate; they are considerably narrowed at the apex. The third joint of the antennæ is very little longer than second, the fourth equals the second and third together, and is a little longer than the fifth. The elytral epipleuræ are very narrow, but can be traced to near the apex. All the tibiæ are mucronated.

Monolepta croceicollis, Germ., must be much like some varieties of this insect in respect of size and colours, but *inter alia* that species is said to have the third and fourth joints of the antennæ "subequal."

Common near Port Lincoln. I have not seen it from other localities.

Digitized by Google

M. simulatrix, sp. nov. Oblonga; sat nitida; fusca; tarsis obscurioribus; antennis (basi excepta) nigris; capite prothoraceque sparsim subtiliter, elytris minus subtiliter minus sparsim, punctulatis. Long., 2 l.; lat., 1 l. (vix).

Very like *M. inconspicua*, but larger, and with longer antennæ, which, however, are shorter than those of the specimen mentioned above as possibly the male of that species. The antennæ, moreover, are wholly black, excepting the basal three joints, while in *M. inconspicua* the joints beyond the third are only near their apex, of a darker shade of fuscous than at their base; joints 2 and 3 are about equal to each other, and (together) both to joint 1 and joint 4. The puncturation of the elytra is evidently finer and a little closer than in *M. inconspicua*.

Sent to me from Western Australia by E. Meyrick, Esq.

M. (?) *quæsita*, sp. nov. Oblonga; sat nitida; æneo-nigra; antennis piceis basi testaceis; pedibus anticis (femoribus basi piceis exceptis) testaceis, intermediis (femoribus apice tibiisque basi testeceis exceptis) et posticis piceis; capite vix perspicue, prothorace subtilius crebrius, elytris crassis, punctulatis. Long., $1\frac{2}{5}$ l.; lat., $\frac{3}{5}$ l.

I unfortunately possess only a single example of this insect, and it has dried in a position in which I cannot see the structure of the anterior coxal cavities as distinctly as I could wish, but I am almost certain that they are closed behind. I have, however, placed this doubt on record by the note of interrogation above. The species bears much general resemblance to a darkly-coloured example of *Monolepta modesta*, differing, however, in its antennæ, which (in one sex at least) are scarcely shorter than the body, having the basal joint evidently longer than any of the following three, the second less than half the length of the first, the third a little longer than the second and only a little shorter than the fourth; the basal four joints testaceous, the rest piceous. The head and prothorax are like those of *M. modesta*, but the latter is proportionally smaller. The epipleuræ of the elytra are better developed behind the middle than in the other species of *Monolepta* described above.

Port Lincoln.

COCCINELLIDÆ.

The species treated of in this paper belong to the group of *Coccinellidæ*, called by M. Mulsant *Trichosomidæ*. The number of new species I have to add—all, or nearly all, of them occurring in the southern part of this colony—are more than the entire number previously known from the whole of Australia; from which it will appear that this group of insects presents a very inviting field for the researches of the Australian naturalist.

Digitized by Google

In Mr. Masters' "Catalogue of the described *Coleoptera* of Australia" there are twenty-two species belonging to this group recorded, but besides there are seven others that appear to have been accidently omitted from the catalogue, making a total (so far as I have been able to ascertain) of twenty-nine.

The *Trichosomidæ* of Mulsant contains a group, *Epilachnides*, which Dr. Chapuis has since, apparently with good reason, elevated to the rank of a principal division of the *Coccinellidæ*. If the Australian *Epilachnides* be abstracted, the number of species of true *Coccinellidæ* of the pubescent group hitherto recorded as occurring on the continent is reduced to twenty-two. I do not think that the division of the family into a pubescent and a non-pubescent group is altogether natural, but as it happens accidently that my present paper has to do only with the former (owing to my having no new species of the latter before me), it will be convenient to my present purpose by accepting that division to avoid having to distinguish the new genera and species before me from any of the non-pubescent group.

Dr. Erichsen was the first to describe Australian insects of this group. In his "Beitrag zur Insecten-Fauna von Vandiemensland" (1842) he describes three species as members of the genus *Scymnus*. In 1851 M. Mulsant, in his great work, "Species des Coléoptéres *Trimères sécuripalpes*," characterised seven additional species apportioned among three genera, and in a supplement to the same, two years later, added four more. In 1859 M. Bohemann described an additional species; in 1874 Mr. Crotch (in his "Revision of the Coccinellidæ") another six, and finally in 1876 Dr. Chapuis (Gen. Col. xii.) one more still. Of these, two are attributed by their author to our own colony, one is stated to be from New South Wales, one from Victoria, one from Western Australia, while three are Tasmanian, and seven come from Queensland, the remainder being vaguely set down as inhabiting "Australia."

The Australian *Coccinellidæ* that have received names have been more fortunate than many of our *Coleoptera* in having been intelligibly described, and there are comparatively few whose identification is attended with much uncertainty; I trust that I may prove to have maintained this excellent character for the group in the descriptions that I now offer to the Society.

The principal difficulty that I have encountered in dealing with the following species has been their apportionment into genera. I am of opinion that a large number of new generic names will be eventually required for the Australian pubescent *Coccinellidæ*, but I do not think that the work of providing them is one that it would be wise for a student resident in Australia to undertake. Such contributions to science, if they are to be of permanent (or

Digitized by Google

perhaps I should say of *any*) value must have regard to more than local fauna, and can hardly be made profitably by any who have not access to the vast collections that are stored in the great museums of Europe. Recognising this fact I have adopted the principle of referring the new species I have to describe to existing genera wherever it is at all possible to do so, adding as full information as I can give of the characters that render their position in those genera only provisional. I propose new generic names only for insects which would be so out of place in known genera that their location there would be likely to mislead. Accordingly it will be found that I have attributed by far the larger number of the Coleoptera described to the genera *Scymnus* and *Rhizobius*, although some, at least, of them can hardly be considered truly congeneric with European types.

To *Scymnus* I have referred all the species before me presenting the following combination of characters:—Eyes neither coarsely granulated nor oblique in position; antennæ short, of not less than ten joints;* epipleuræ devoid of well-defined foveæ; prosternum not provided with a prolongation covering the mouth organs in repose, mesosternum not carinate longitudinally; suture between the first and second ventral segments, obliterated (or at least much enfeebled) in the middle; claws appendiculate; base of antennæ exposed.

All the species I have attributed to *Scymnus* correspond with the above formula, with the exception of the last, which differs in specified respects. Were it not for that species I might add to the formula "abdominal lamellæ incomplete." In some respects (especially the structure of the prosternum) the insects thus associated differ much *inter se*, as I have indicated by dividing them into subgeneric groups, to which, however, I have thought it better not to apply names.

The following I have treated as the essential characters of *Rhizobius*:—Eyes coarsely granulated and oblique in position; antennæ more or less long, of eleven joints; epipleuræ devoid of well-defined foveæ; prosternum not with a prolongation covering the mouth organs in repose; mesosternum not carinate longitudinally; suture between the first and second ventral segments, not noticeably enfeebled in the middle; claws appendiculate; base of antennæ exposed; tibiæ more or less slender.

The species in my hands presenting the above characters differ considerably in some respects *inter se*, enabling me to group them in sections that (unless intermediate forms be subsequently found) would seem to be of generic value.

---

* I believe that in all cases they consist of eleven joints; in the case of several species, however, I have been unable to satisfy myself absolutely on the point.

Digitized by Google

Mr. Crotch (in his "Revision of the *Coccinellidæ*" 1874) points out that *Rhizobius* and its allies are distinguished from other members of the family by having the anterior coxal cavities open behind. This appears to be a very important observation, but unfortunately generally involves the sacrifice of a specimen for its application, so I have not been able to make full use of it, but, so far as I have been able to ascertain, the species I have referred to *Rhizobius* present the character in question.

For five species I have been compelled, with great reluctance, to propose five new generic names; they all possess strongly marked characters that are quite incompatible with those of any genus I can ascertain to have been previously named.

The remaining three species I have attributed to *Eupalea* (with extreme doubt) and *Novius*.

Of the remaining five genera already attributed to Australia, *Hypocerus*, *Platyomus*, and *Pharus* are known to me only by description; the first has the epistoma emarginate and the antennæ only eight-jointed; the second has the mesosternum carinate; and the third has the base of the antennæ concealed, together with epipleuræ devoid of well-defined foveæ. I possess types of the other two, *Cryptolæmus* (a Northern Australian form only, so far as I know, with the prosternum produced over the mouth organs in repose), and *Bucolus* (common in South Australia, having well defined epipleural foveæ, together with a moderately produced prosternum).

The following table indicates some of the distinctive characters of the Australian genera of pubescent *Coccinellidæ*:—

A. Femora not falling into excavations of the under surface.
  B. Base of antennæ not hidden behind the dilated epistoma.
    C. Epipleuræ devoid of well-defined foveæ.
      D. Antennæ formed of more than eight joints.
        E. Mesosternum not longitudinally carinate.
          F. Prosternum not produced to cover the mouth organs.
            G. Length of antennæ exceeding width of space between the eyes.
              H. Eyes very coarsely granulated. *Rhizobius*.
              HH. Eyes more or less finely granulated. *Eupalea* (?).
            GG. Length of antennæ not exceeding width of space between the eyes.
              I. Suture between first and second ventral segments enfeebled or obliterated in the middle. *Scymnus*.

Digitized by Google

II. This suture not noticeably enfeebled in the middle. *Scymnodes.*

FF. Prosternum produced to cover the mouth organs. *Cryptolæmus.*

EE. Mesosternum carinate. *Platyomus.*

DD. Antennæ formed of only eight joints.

K. Epistoma truncate in front. *Novius.*

KK. Epistoma emarginate in front. *Hypocerus.*

CC. Epipleuræ with well defined foveæ.

L. Prosternum short. *Bucolellus.*

LL. Prosternum long. *Bucolus.*

BB. Base of the antennæ hidden behind the dilated epistoma.

M. Epipleuræ with well defined foveæ. *Lipernes.*

MM. Epipleuræ devoid of well defined foveæ. *Pharus.*

AA. Femora fitting into excavations of the under surface.

N. Tibiæ fitting into sulci on under surface of femora. *Serangium.*

NN. Femora normally sulcated. *Cyrema.*

EUPALEA.

It is with much hesitation that I attribute the following species to the tropical South American genus *Eupalea*, notwithstanding that in the supplement to his work M. Mulsant himself (the author of the genus) attributes an Australian species to it (which, however, Mr. Crotch regards as a mistake). The possession of the following characters would seem to place the insect before me in the group of *Coccinellidæ*, which Dr. Chapuis calls "Poriites," viz., base of antennæ exposed, epipleuræ not bearing well-defined foveæ, body pubescent, epistoma entire in front, antennæ long enough to reach the base of the prothorax (or nearly so), and having the apical joints elongate. From *Rhizobius* (which agrees with it in most of these respects) it differs by its finely granulated large eyes, with their inner margins subparallel.

The group *Poriites*, according to Dr. Chapuis, contains two genera—*Poria* and *Eupalea*—both inhabiting tropical America, though Dr. Chapuis alludes to M. Mulsant's Australian species, and adds that he has himself a species from Australia in his own collection.

The present insect agrees with *Eupalea* in most respects—especially in the structure of the antennæ, in the rather peculiar prosternal structure, in the situation of the epipleuræ opposite the hind femora, and in the small size of the abdominal lamellæ. It differs from the characters of *Eupalea* (as given by Dr. Chapuis) in the finer granulation of the eyes, which are not distinctly sinuated on their internal margin, in the not particularly small

Digitized by Google

scutellum, and in the claws. These latter are unusually small, and so bent under the last joint of the tarsi that I found them exceedingly difficult to examine. I think, however, that they are certainly appendiculate, with the inner apex of the basal piece somewhat produced, while in *Eupalea* they are said to be bifid, with the inner division short and basal. As this may be a different way of describing the same character, I do not like to found a genus on it. Nevertheless, the present insect is so much smaller and so differently coloured from the South American species, that it can only be provisionally associated with them. The intermediate and (especially) the hind coxæ are unusually widely separated—a character not mentioned as pertaining to *Eupalea*. The first ventral suture is as strongly marked as the others.

E. (?) *rotunda*, sp. nov. Sub-hemisphæricus; convexus; sat nitidus; pubescens; læte brunneus; prothoracis disco, metasterno abdomine medio, et tarsis, plus minus picescentibus; capite prothoraceque subtiliter, elytris minus subtiliter, sat crebre punctulatis. Long., 1 l.; lat., $\frac{4}{5}$ l.

The almost circular outline and clear, bright brown colour (with only the disc of the prothorax infuscate) of the upper surface of this insect render it at a glance very different from any other Australian *Coccinellid* known to me. For the sake of comparing its puncturation with that of a common species, I may say that its elytra are punctured a little, but not much, more finely than those of *Rhizobius ventralis*, Er. In one of my two examples the suture of the elytra is a little infuscate.

Port Lincoln.

NOVIUS.

N. Lindi, sp. nov. Breviter ovalis; minus convexus; nitidus; pubescens; niger; elytris macula rufa instructis; antennis, palpis, tibiis apice, et tarsis, rufopiceis; capite prothoraceque vix perspicue, elytris crebre subtilius, punctulatis. Long., 1 l.; lat., $\frac{4}{5}$ l.

Each elytron bears a well-defined oblong bright red spot, the hinder end of which reaches about the middle of the length of the elytron, and which is placed near to the suture. The head is wide; the eyes are large and finely granulated, their inner margins parallel. The prothorax is rather more than twice as wide as long down the middle, its front bisinuate, the middle being produced forward, its anterior angles little produced and narrowly rounded off, its sides gently arched and narrowed towards the base (with which they form a very obtuse angle) the latter being strongly arched backward all across and fitting into a deep common emargination of the elytra. The scutellum is triangular and

Digitized by Google

moderately large. The prosternum is extremely short, not longer than the mesosternum; between the coxæ it appears as a concave lamina scarcely longer than its width behind, with a continuous elevated margin except at its line of contact with the mesosternum, and somewhat narrowed to the front, where it is rounded. The mesosternum is much like that of *Orcus* in size and shape, but is a little more convex; its front is truncate, or almost convex. There is a well-defined sixth ventral segment, and the basal ventral suture is not less marked than the others. The epipleuræ are moderately wide and horizontal at the base, but become gradually narrower and vertical, disappearing altogether before the apex; they are not foveated. The femora and tibiæ are all strongly compressed, the former being deeply grooved for the reception of the latter. The tarsi are very stout. The abdominal lamellæ are complete, and extend back about two-thirds the length of the basal ventral segment. The prothorax is not narrower at its base than the true base of the elytra, but the latter dilate very rapidly immediately from the base, and the humeral angle is so slightly marked that until carefully examined the anterior part of the lateral margin might pass for a portion of the base.

Port Lincoln.

N. bellus, sp. nov. Breviter ovalis; minus convexus; nitidus; pubescens; niger; prothoracis dimidio apicali, elytris vittis maculisque nonnullis, antennis, epipleuris in parte, et segmentis ventralibus in parte, læte rufis; pedibus piceis, tarsis rufescentibus; capite prothoraceque vix perspicue, elytris crebre subtilius, punctulatis. Long., $1\frac{3}{10}$ l.; lat., 1 l.

A very pretty *Scymnid*, the red markings being very bright and sharply defined. On each elytron they are as follows:—(*a*) A vitta parallel and near to the suture, extending from the base about four-fifths of the distance to the apex, very wide in front and quickly narrowed (somewhat resembling a dumb bell with one of the knobs broken off); (*b*) a vitta occupying the front half of the lateral margin, and dilated at its base so as to meet the sutural vitta about the middle of the base; (*c*) a large discal spot just behind the middle; (*d*) an apical spot. The red parts of the epipleuræ correspond with the marginal and apical red portions of the upper surface. This species does not appear to differ structurally from *Lindi* in any respect, and its sculpture is very similar. Apart from the totally different coloration it is a larger and more convex insect.

Sedan; taken by Mr. B. S. Rothe.

SCYMNODES, *gen. nov.*

Caput prothoraci modice insertum; antennarum basis aperta; oculi sat magni, subtiliter granulati, intus subparalleli;

Digitized by Google

epipleuræ antice sat latæ, elytrorum in parte quarta postica obsoletæ, haud perspicue foveatæ; prosternum in medio longitudinaliter depressum (spatio depresso utrinque carinato, angusto, abasi ad apicem angustato, apice acuto); mesosternum sat magnum, antice leviter emarginatum; abdomen segmentis 6 conformatum; suturæ ventrales bene impressæ; lamellæ abdominales segmenti basalis apicem fere attingentes, integræ; tibiæ et femora sat fortiter compressæ; antennæ articulis 10 conformatæ, minus breves; corpus pubescens; unguicula appendiculata.

The insect for which I form this genus differs from nearly all hitherto described Australian pubescent *Coccinellidæ* by its antennæ of ten clearly defined joints. The basal two joints are large and dilated, 3 much narrower and rather elongate, 4 evidently shorter than 3, 5 and 6 a little shorter than 4, 7 to 9 gradually longer and wider, 10 pointed. From *Cryptolæmus*, which has very similar antennæ, it may be at once distinguished by the entirely different structure of the prosternum and claws, by the well defined sixth ventral segment, and the greater breadth of the elytral epipleuræ in front. The mesosternum is remarkably like that of *Cryptolæmus*, near which genus I think this one should certainly be placed.

S. difficilis, sp. nov. Sat late ovalis; minus convexus; nitidus; dense albido-pubescens; subtilius sat crebre punctulatus; rufo-ferrugineus; capite postice, prothoracis disco, elytris (apice obscure rufo excepto), prosterno medio, mesosterno, metasterno, et segmento ventrali basali medio, nigro-æneis. Long., 2 l. (vix); lat., $1\frac{2}{5}$ l.

The superficial resemblance of this insect to some of the Australian species of *Rhizobius* is very remarkable. Having only a single specimen I am unable to ascertain certainly whether the anterior cotyloid cavities are open behind, but as far as I can see they are not. The prothorax is about twice as wide as long down the middle, its anterior margin feebly concave but rather strongly sinuate behind the eyes, the base about half again as wide as the front margin, the sides gently arched, the front angles rather prominent but not sharp, the hind angles well developed and gently obtuse. The whitish pubescence is dense uniform and rather woolly looking over the upper surface—it is mixed with a few erect longer ferruginous hairs. The puncturation is a little stronger on the head and a little closer on the prothorax than on the elytra; it does not very nearly resemble the puncturation of any other of the common species known to me, being (on the elytra) about as close as in *R. ventralis*, Er., but

Digitized by Google

besides being finer than in that insect, it has a faint, obliterated, appearance.

South Australia; I am not sure whether I took this specimen near Adelaide or in the Port Lincoln district.

SCYMNUS.

A. Prosternum antice æqualiter convexum, nec depressum nec carinatum.

S. inusitatus, sp. nov. Ovalis; pubescens; sat convexus; nitidus; piceus; tibiis tarsisque dilutioribus; capite prothoraceque obsolete, elytris fortius crebrius, punctulatis. Long., 1 l.; lat., $\frac{7}{10}$ l.

The mesosternum is of moderate size and is truncate in front; the abdominal lamellæ are incomplete, their hind and external outline being confused with the outline of the basal ventral segment. There are six ventral segments, the apical four not differing much *inter se* in length; the suture between the basal and next segment is very fine and obscure in the middle; the metasternum is impunctate down the middle, its sides (and also the ventral segments) being lightly and sparingly punctulate. The elytral puncturation compared with that of *C. flavifrons*, mihi, is larger, more sparing, and much smoother.

The number of ventral segments in *Scymnus* is stated by Dr. Chapuis as five, but even in some European *Scymni* there is a small sixth segment, so that the development of the sixth segment in the present species may be merely a question of degree. The entire absence of any longitudinal sculpture traversing the median part of the prosternum is also approximated by some European forms attributed to the genus. Therefore, although it is likely that these peculiarities will sooner or later be regarded as valid generic characters, I do not think they call for the immediate creation of a new name.

Near Port Lincoln; taken by sweeping low plants.

AA. Prosternum medio longitudinaliter depressum, spatio depresso utrinque longitudinaliter carinato.

B. Spatio depresso sat lato plus minus parallelo.

S. insidiosus, sp. nov. Breviter ovalis; pubescens; sat convexus; nitidus; piceo niger; capite, prothorace (disco excepto), elytris maculis nonnullis epipleurisque, abdominis apice, et pedibus (tibiis posticis 4 plus minus infuscatis exceptis), testaceis; capite prothoraceque vix perspicue, elytris obscure minus crebre, punctulatis. Long., $\frac{7}{10}$ l.; lat., $\frac{3}{5}$ l. (vix.)

Var. pallipes. Pedibus totis pallide testaceis.

Var. major. Corpore majore, prothorace pedibusque totis testaceis.

Digitized by Google

The markings on the elytra are best described by regarding the testaceous portion as the ground colour. There then appear to be the following pitchy-black markings, viz. :—(*a*) A triangle whose base coincides with the base of the elytra, and whose apex falls on the suture at about half its length, and then is produced somewhat narrowly down the suture to the apex; (*b*) an obscure marginal border; (*c*) an oblique fascia connecting the middle of the marginal border, and the suture at two-thirds of its length from the base. There are only five ventral segments, which, together with the sides of the metasternum, are finely but distinctly punctulate, while the middle portion of the latter is impunctulate. The antennæ are very short; I can only count ten joints distinctly.

In my example of the var. *pallipes* each elytron has an additional pitchy-black portion, forming a longitudinal connection between the fascia and the middle of the side of the common basal triangle, so that the testaceous portion which in the type appears as a vitta (running from the shoulder to near the middle of the suture) is here divided into two pieces. In the var. *major* the markings resemble those of the type, but are less clearly defined. The puncturation in both the vars. seems stronger and better defined than in the type, and they may possibly represent a (or even two) new species. All these bear a remarkable superficial resemblance to *Bucolellus ornatus*, mihi, which, however, besides its generic differences, is punctured very differently.

I have met with the type near Port Lincoln, the var. *pallipes* on Yorke's Peninsula, the var. *major* at Woodville.

S. lubricus, sp. nov. Breviter ovalis; pubescens; sat convexus; sat nitidus; vix perspicue punctulatus; niger; capite, prothoracis lateribus margineque antico, et elytrorum lateribus apiceque, plus minus obscure piceo-rufescentibus; antennis, palpis, pedibusque (femoribus plus minus piceis exceptis), latius rufescentibus. Long. $1\frac{1}{5}$ l.; lat. $\frac{4}{5}$ l.

Under a powerful Coddington lens the elytra near the suture appear punctureless, but towards the sides and apex some excessively minute and decidedly sparse puncturation is traceable; the puncturation is very much feebler than in *S. notescens*. The underside resembles that of *S. Meyricki*, but the metasternum is not distinctly wrinkled transversely. My example has a small sixth ventral segment—the first ventral suture is very fine, but distinct.

Port Lincoln.

S. Meyricki, sp. nov. Breviter ovalis; pubescens; sat convexus; sat nitidus; crebre subtilius punctulatus; niger; capite, prothoracis lateribus margineque antico, elytrorum macula

Digitized by Google

magna ante apicem, antennis, palpis, pedibusque (his femoribus plus minus piceis), rufescentibus. Long., 1½ l.; lat., ⅘ l.

Var. ? *obscuripes*. Capite, prothoracis lateribus, femoribus omnibus, et tibiis 4 posterioribus, piceis.

The red spot on the elytra occupies the posterior declivity, and is not very conspicuous anywhere, but most so close to the suture; it does not quite reach the apex. The sides of the metasternum and the ventral segments are distinctly punctulate, the middle portion of the former finely wrinkled transversely. There is a small sixth ventral segment; the first ventral suture is very fine, but distinct. The puncturation of the upper surface is very much like that of the common *S. flavifrons*, but appears a little less asperate. In most examples the reddish tone is less decided on the head than on the other red parts.

The puncturation of the var.? is slightly feebler, and more sparse than in the type; it is very likely to be a distinct species, but may possibly be the other sex of the same.

The type was collected in Western Australia by E. Meyrick, Esq., the var. ? near Port Lincoln by myself.

S. Poonindiensis, sp. nov. Breviter ovalis; pubescens; sat convexus; sat nitidus; niger; capite, prothoracis angulis anticis margineque antico, antennis, palpis, femoribus anticis, et tibiis tarsisque omnibus, testaceis; elytris obscure rufo-umbratis, epipleuris plus minus rufescentibus; capite subtilius sat crebre, prothorace vix perspicue, elytris subtiliter sat crebre, punctulatis. Long., 1⅕ l. (vix); lat. ⅘ l.

? Sexus alter. Capite (labro excepto) piceo.

In the type the reddish tone on the elytra is comparatively slight, and is vaguely diffused over the sides and apex; in the specimen mentioned as "? Sexus alter" obscure red is the prevailing colour of the elytra, black being confined to a common space included within a line on either side running from the humeral callus obliquely towards the middle of the suture, and thence continued parallel and close to it to the apex. The puncturation of the elytra is much like that of *S. Meyrickí*, but the impunctate prothorax renders this insect very distinct. The middle of the metasternum is scarcely wrinkled; there are five ventral segments; the first ventral suture is distinct, but fine.

Poonindie, near Port Lincoln.

S. Casuarinæ, sp. nov. Breviter ovalis; pubescens; minus convexus; nitidus; brunneo-ferrugineus; capite, prothorace (disco piceo excepto), antennis, palpis, pedibusque (his femoribus posticis exceptis), epipleuris, et abdominis apice, testaceis; metasterno et abdominis segmentis basalibus nonnullis piceis; capite subtiliter sat crebre, prothorace vix

Digitized by Google

perspicue, elytris suturam versus antice crebre sat fortiter, his latera apicemque versus gradatim obsoletius, punctulatis. Long., 1 l.; lat., $\frac{4}{5}$ l. (vix).

This species is easily distinguished by the puncturation of its elytra, which is almost coarse over a small space on either side of the suture a little behind the scutellum, and thence becomes finer and more obsolete in all directions. The sides of the metasternum and the ventral segments are rather coarsely punctured, the middle of the metasternum is almost sculptureless. There are five ventral segments; the first ventral suture is fine, but very distinct.

Port Lincoln; beaten from Sheoak (Casuarina).

S. simplex, sp. nov. Breviter ovalis; pubescens; minus convexus; nitidus; crebre subtiliter punctulatus; piceo-brunneus; capite, prothorace (disco piceo excepto), antennis, palpis, tibiis, tarsisque, sordide testaceis; metasterno elytrisque piceis; his obscure rufo-maculatis. Long., $1\frac{1}{5}$ l.; lat., $\frac{4}{5}$ l.

The most nearly allied, perhaps, to *S. Meyricki*, which, however, is not so closely punctured as the present species. The red marking on the elytra consists of a small ill-defined, and not at all conspicuous, blotch near the lateral margin a little behind its middle. The sides of the metasternum are finely and very closely punctured; the middle is almost sculptureless. The puncturation of the ventral segments is moderately fine and close near the base, and becomes gradually finer and closer to the apex. There are five ventral segments; the first ventral suture, though finer in the middle than the rest, is very distinct.

Petersburg (S.A.); beaten from pine.

S. aspersus, sp. nov. Ovalis; pubescens; sat convexus; nitidus; sparsim subtilissime (elytris latera apicemque versus magis perspicue exceptis) punctulatus; piceus; capite, prothoracis angulis anticis, elytris maculis nonnullis, prosterno (obscure), epipleuris, antennis, palpis, tibiis anticis, et tarsis omnibus, testaceis. Long., $\frac{4}{5}$ l.; lat., $\frac{3}{5}$ l. (vix).

The testaceous marks on the elytra are very obscure, and consist of an elongate spot on either side of the middle of the suture and an oblique line (somewhat resembling a fascia abbreviated at both ends) near the apex. The puncturation of the head and prothorax cannot be seen without a powerful lens; that of the elytra is similar near the scutellum, but becomes gradually better defined towards the sides and apex. On the underside the middle of the metasternum is scarcely punctulate, bnt bears some fine transverse wrinkles; there is a distinct sixth ventral segment;

Digitized by Google

the ventral segments are finely and sparsely punctured, the basal ventral suture almost obliterated in the middle.

Port Lincoln (S.A.).

S. australis, sp. nov. Sat breviter ovalis; breviter pubescens; subtilissime crebrius punctulatus; subtus rubro-ferrugineus, supra fusco-testaceus; prothoracis basi lateribusque et elytrorum sutura, marginibus, maculisque pone basin nonnullis, piceo-nigris; antennis palpis pedibusque testaceis, tibiis (nonnullis exemplis) infuscatis. Long., 1 l. (vix); lat., $\frac{3}{5}$ l.

I do not observe any structural difference between this species and *S. aurugineus*, except that this is wider and less parallel in form; its puncturation is so fine and faint as to be scarcely visible under a strong lens. The basal margin of the prothorax, and lateral margins of it and the elytra, are very narrowly blackish; the suture is more widely so; in this typical specimen there is a black spot on the humeral callus and another between it and the suture, and an obscure piceous cloud on the hinder part of the disc, but in other examples some of these spots are wanting. On the underside the pale testaceous colour of the reflexed margin of the elytra is in strong contrast with the dark red general surface.

Petersburg (South Australia).

S. flavifrons, sp. nov. Breviter ovalis; pubescens; niger vel piceus; capite, prothorace antice et lateraliter, pedibus 4 anticis, tibiis tarsisque posticis, læte flavis; elytris apicem versus rufescentibus; capite prothoraceque subtilissime, elytris minus subtiliter, punctulatis; sutura ventrali prima in medio obliterata. Long., $\frac{4}{5}$ l.; lat., $\frac{3}{5}$ l. (vix).

The yellow area on the prothorax is limited behind by a regular curve with its extremities at the posterior angles and its middle nearly touching the middle of the anterior margin of the segment. The pubescence is moderately dense, and semierect (or at least not flatly depressed), and is of a shining silvery white colour. The puncturation is moderately fine and rather dense, and has an asperate appearance as though there were a tendency to granulation on the intervals between the punctures; it is a little more dense near the sides than elsewhere, and scarcely differs on the upper and under surface except in the middle part of the metasternum being almost lævigate; it is not unlike that of the European *S. capitatus*, Fab., but is a little finer and closer.

Common, and widely distributed in South Australia, occurring as far North as Lakes Torrens and Eyre, also near Adelaide, in the West, &c.

In company with the above, and equally commonly, I find specimens which I conjecture to be the other sex (probably

Digitized by Google

female). They differ in having the yellow colouring less vivid and confined to the mouth organs, legs (even these being in some examples clouded with brown), and (in occasional examples) the extremities of the anterior margin of the prothorax. The anterior prolongation of the metasternum appears to be a little wider than in the type, and on this account there is a possibility of their being a distinct species.

The following forms appear to me to be merely varieties or local races of *S. flavifrons*:—

var? *occidentalis*. Differt maris capite prothoraceque minus argute flavo tinctis, elytris postice haud vel vix rufescentibus; feminæ pedibus lætius testaceis. Sent to me from Western Australia by E. Meyrick, Esq.

var? *Victoriæ*. Differt magnitudine (1 l.) et feminæ (mare haud observato) pedibus lætius testaceis, prothoracis angulis anticis lætius rufescentibus, elytrisque apicem versus haud rufescentibus. Taken by me in Western Victoria.

S. aurugineus, sp. nov. Sat elongato-ovalis, aureo-pubescens; leviter minus crebre punctulatus; piceus; supra ferrugineus, elytris ante medium V aureo conspicue ornatis; antennis palpis pedibus et abdominis apice ferrugineus. Long., $1\frac{1}{10}$ l.; lat., $\frac{3}{5}$ l.

Apparently not a variable insect; rather narrow and parallel. The puncturation of the upper surface smoother finer and less close, that of the underside very much more sparing, than in *S. flavifrons*; the middle of the metasternum without visible punctures. The elytra has a mottled (yellow and reddish) appearance difficult to describe in detail, but in all the examples I have seen there is on each elytron a golden yellow vitta (very conspicuous in certain lights), which runs from immediately below the shoulder obliquely to just in front of the middle of the suture, which, however, it does not quite touch—the vittæ of the two elytra thus forming a V (the two arms, however, not quite meeting at the angle). On each elytron the darkest colouring (in some examples deep pitchy) forms a margin on both sides of the vitta. The suture between the first and second ventral segments is fine but distinct.

Widely distributed in South Australia, but apparently not very common. I have it from Kapunda, Petersburg, and Lake Torrens.

BB. Spatio depresso angusto antice subacuto.

S. notescens, sp. nov. Breviter ovalis; capillis sat elongatis erectis sat dense vestitus; sparsius subtilius punctulatus; niger, elytris antice macula permagna testacea notatis; labro,

Digitized by Google

palpis, antennis, tibiis, tarsis, prothoracisque angulis anticis, plus minus rufescentibus. Long., 1 l.; lat., $\frac{4}{5}$ l.

Maris capite, prothoracis lateribus et femoribus anticis læte rufis.

Much more sparingly punctured than either of the preceding two species. The testaceous spot on each elytron comes near touching both the suture and the lateral margin; its front edge is separated from the anterior margin by a distance equal to about two-thirds the length of the prothorax, and its hind margin falls a little behind the middle of the elytron. In shape it may be described as a quadrate figure a little wider than long, deeply emarginate posteriorly, and having its antero-external corner cut off or emarginate. The suture between the first and second ventral segments is fine but distinct,

Common near Port Lincoln; also in the Adelaide district.

AAA. Prosternum inter coxas longitudinaliter bicarinatum, antice æqualiter convexum.

C. Lamellæ abdominalis haud integræ.

S. oscillans, sp. nov. Ovalis; pubescens; sat convexus; nitidus; piceus; prothoracis lateribus, antennis, palpis, epipleuris, pedibusque, testaceis; elytris piceo-brunneis, latera apicemque versus dilutioribus; capite prothoraceque subtiliter minus crebre, elytris sparsius distincte, punctulatis. Long., $1\frac{1}{10}$ l.; lat., $\frac{7}{10}$ l.

The puncturation, compared with that of *S. flavifrons, simplex*, &c., is much smoother and more sparse. It is not unlike that of *S. Meyricki*, which, however, is a wider insect proportionally. The sculpture of the prosternum at once distinguishes it from nearly all its allies. The sides of the metasternum are closely, and the ventral segments less closely, punctured; the middle of the former is finely wrinkled transversely. There is a small distinct sixth ventral segment. The first ventral suture is fine, but distinct.

Petersburg, S.A.

S. Sedani, sp. nov. Breviter ovalis; sat convexus; nitidus; pubescens; piceus; elytris rufo bimaculatis; abdomine rufescenti; tibiis, tarsis, epipleurisque, sordide testaceis; capite prothoraceque subtiliter crebrius, elytris fortius minus crebre, punctulatis. Long., $1\frac{1}{2}$ l.; lat., 1 l.

The elytra are broadly red in the basal third of the lateral margin, and this red mark is prolonged from its hinder end obliquely towards the suture which it approaches (but not very closely) just in front of the middle; the hinder red spot occupies the apical one-sixth of the elytra. The puncturation of the elytra is stronger than in any of the *Scymni* described above. The

Digitized by Google

metasternum at its sides and ventral segments are rather strongly punctured, the former much more closely than the latter. The middle of the metasternum is obscurely punctulate. There are only five ventral segments. The basal ventral suture is nearly obliterated in the middle.

Sedan, S.A.; taken by Mr. B. S. Röthe.

CC. Lamellæ abdominales integræ.

S. parallelus, sp. nov. Oblongus; subparallelus; minus convexus; nitidus; pubescens; piceus vel ferrugineo-piceus; tibiis, tarsorum basi, et elytris singulis vitta lata, testaceis; capite subtiliter obscure, prothorace vix perspicue, elytris crassius subrugulose, punctulatis. Long., $\frac{4}{5}$ l.; lat., $\frac{2}{5}$ l.

Not very like *Scymnus* in general apperance, owing to its more elongate flattened form and not very finely granulated eyes; it is, moreover, the only Australian species (known to me) attributable to the genus in which the abdominal lamellæ are entire, but I cannot find any satisfactory character for separating it. The upper surface is of a shining pitchy colour, inclining to ferruginous about the sides of the elytra, each of which bears a wide and rather obscure testaceous vitta commencing about the middle of the front margin, running down the disc to near the apex, and then turning towards and meeting the suture; the inner margin of this vitta is better defined than the outer, so that the two vittæ (meeting near the apex) enclose an elongate common space of a deep piceous colour, and externally merge by gradual shades of colour into the general hue. In one of my two examples nearly the whole under surface is reddish, including the femora; in the other it is pitchy, with the apical segments reddish. The prothorax is scarcely twice as wide as long, its front scarcely emarginate, the front angles but little produced and not sharp, the hind sharply rectangular, the base not much wider than the front, the sides nearly straight. The abdominal lamellæ nearly reach the apex of the basal ventral segment, and are very narrow, their external margin being on the front of the segment, nearly as far from the lateral margin of the segment as the whole width of the lamella along the front margin. The first ventral suture, though perfectly distinct, is evidently feebler in the middle than the other sutures. In one example there is a distinct, in the other a scarcely distinct, small sixth ventral segment. The infuscation of the claw joint of the tarsi is (if invariable) a conspicuous character. The epipleuræ are more or less testaceous.

Port Lincoln.

RHIZOBIUS.

A. Prosternum medio longitudinaliter depressum, spatio depresso utrinque longitudinaliter carinato.

Digitized by Google

R. discolor, *Er.* [var (?) *proprius.*] The insect which I attribute to this species measures 2½ l. in length, whereas *R. (Scymnus) discolor* is said to be 2 l., and there is evidently some confusion or mistake about the size, for comparing it with *R. (Scymnus) ventralis*, which is said to be 2¼ l., Erichsen calls it "duplo fere minor." Besides this, my specimen displays some colour discrepancy, its upper surface being red brown, inclining to pitchy on the head and prothorax, with the margins of the latter, the shoulders, and the suture, bright red; whereas Erichsen makes the colour black, with the head and the lateral margins of the prothorax red. According to Erichsen the prothorax should be rather sparingly punctulate, whereas in my example this segment (though less closely punctured than the elytra) bears decidedly dense puncturation at the sides, while that of the disc is a little more sparse. The elytra are strongly subrugosely and very closely punctured, and have obsolete indications of striation, but without the slightest tendency to linear puncturation. The whole upper surface is clothed with short, very fine, sub-recumbent pubescence, among which are other hairs standing up more erectly and evidently (though not very much) stouter and longer.

Compared with the European *R. liturus*, Fab., this insect is very much larger and much more parallel-sided in form, with the prothorax very much more transverse (twice as wide as long), its sides being more strongly rounded. The puncturation throughout is very similar to that of *R. liturus*.

As I have seen several specimens of the above described form not varying *inter se*, except in a tendency in some to a reddening of the elytral margins as well as the suture, it would seem to represent at least a localized variety deserving of a name, and is very likely to be a species distinct from the Tasmanian original. I may add that M. Mulsant mentions the testaceous color of the abdominal plates as a character of *R. discolor*; this is not alluded to by Erichsen, nor do I find it in specimens before me,—which have the underside of a nearly unicolorous ferruginous, the abdominal plates extending back not much more than half the length of the basal ventral segment, and being punctured uniformly with the segment itself.

Occurs near Port Lincoln.

R. cyaneus, sp. nov. Elongatus; vix subparallelus; pubescens; subnitidus; supra (capite piceo excepto) obscure cyaneus; subtus, antennis, palpis, pedibusque, obscure ferrugineis; prothorace quam longiori minus duplo latiori, elytris sat angustiori, antice leviter angustato, lateribus leviter arcuatis, angulis anticis subrotundatis haud prominulis, posticis sub-

Digitized by Google

rectis; capite prothoraceque subtilius sparsius, elytris subfortiter sat crebre, punctulatis; metasterno medio sparsim subtiliter punctulato, transversim vix rugato. Long., 1⅜ l.; lat., ⅝ l.

The abdominal plates reach back nearly to the apex of the basal segment, and are punctured much more sparsely than the lateral portion of the segment. The flattened ridge of the prosternum is at its widest immediately behind the front. The pubescence of the upper surface is mixed with hairs that are somewhat stouter and more erect than the rest.

A single specimen occurred to me in Western Victoria.

R. læticulus, sp. nov. Minus elongatus; vix subparallelus; sat æqualiter pubescens; nitidus; piceus; capite, prothorace, pedibus, prosterno, abdominis apice, et (nonnullis exemplis) signaturis quibusdam in elytris positis, testaceis; prothorace quam longiori fere duplo latiori, elytris angustiori, antice minus angustato, lateribus minus rotundatis, angulis anticis rotundatis haud prominulis posticis subrectis; capite prothoraceque subtiliter, elytris minus subtiliter, sparsim punctulatis; metasterno subtiliter transversim rugato, vix perspicue punctulato. Long., 1 l.; lat., ⅜ l.

In one example (the most highly coloured) the prothorax is dark red in the middle, becoming bright testaceous at the sides; and on the elytra the shoulders, together with an obscure vitta near the suture, are testaceous; in others the whole prothorax is uniformly reddish and the elytra are nearly unicolorous. The abdominal plates are about two-thirds the length of the basal segment, and are punctured as strongly and nearly as closely as the general surface of the segment.

Woodville.

R. Evansi, Muls. Ovalis; sat convexus; pubescens; sat nitidus; supra piceo-niger vix æneo-tinctus; capite, prothorace (plus minus), corpore subtus, antennis, palpis pedibusque, ferrugineis; prothorace quam longiori vix duplo latiori, elytris basi parum angustiori, antice sat angustato, lateribus subrectis, angulis anticis rotundatis subprominulis, posticis obtusis; capite prothoraceque crebrius subfortiter, elytris crebre sat fortiter (latera versus præsertim) punctulatis; metasterno medio (antice præsertim) fortius crebrius punctulato. Long., 1⅜—2 l.; lat., 1⅛—1⅜ l,

The abdominal plates are about three-fourths the length of the basal segment, and are punctured more strongly and less closely than the sides of the segment. The flattened ridge of the prosternum is uniformly narrowed from its base to the front. The

Digitized by Google

pubescence of the upper surface is of a silvery white colour, and is much mixed with long erect hairs. Compared with the European *R. liturus* this species is much wider, with more strongly rounded sides and much stronger puncturation.

I have re-described this insect, because the original description is very incomplete and founded on a very pale specimen. I do not think there is any doubt of the correctness of my identification.

Apparently common all over Southern Australia.

R. insipidus, sp. nov. Elongato-ovalis; sat convexus; pubescens; minus nitidus; totus brunneus (meso- et meta-sternis et abdomine piceis exceptis); prothorace quam longiori paullo minus duplo latiori, elytris basi vix angustiori, antice vix angustato, lateribus parum arcuatis, angulis anticis plane rotundatis haud prominulis, postice subrectis; capite prothoraceque subtiliter, elytris sat fortiter, sat crebre punctulatis; metasterno medio subtiliter transversim rugato vix perspicue punctulato. Long., $1\frac{1}{5}$ l.; lat., $\frac{4}{5}$ l.

The abdominal plates nearly reach the apex of the basal segment, and are punctured a little more sparingly than the sides of the segment. The flattened ridge of the prosternum is strongly narrowed from its base to the front, which is pointed. The pubescence of the upper surface is whitish-brown in colour, and is mixed with a few rather long erect hairs. In some examples the suture is narrowly infuscate, and in some the elytra have a slight opalescent greenish gloss. The puncturation of the elytra is less strong than in *R. Evansi* and *R. cyaneus*, and slightly stronger than in *R. læticulus*. It is very similar to that of *R. liturus*, Fab.

Roseworthy, S.A., and Kangaroo Island.

R. debilis, sp. nov. Ovalis; sat convexus; pubescens; nitidus; supra piceo-niger vix æneo-tinctus; capite, prothorace, corpore subtus, antennis, palpis, pedibusque, plus minus ferrugineis; prothorace quam longiori duplo latiori, elytris basi vix angustiori, antice sat angustato, lateribus subrectis (marginibus subfortiter reflexis), angulis anticis rotundatis, posticis distinctis obtusis; capite prothoraceque minute sat crebre, elytris prope scutellum subtilissime sparsim (latera apicemque versus magis distincte), punctulatis; metasterno medio vix distincte sculpturato. Long., $1\frac{2}{5}$ l; lat., $\frac{4}{5}$ l.

An obscure species resembling *R. Evansi*, but smaller and differently punctured, the punctures on the elytra near the scutellum being scarcely visible under a Coddington lens. The prothorax is very wide and short, with its lateral edges more strongly reflexed than is usual in the genus, especially at the anterior angles, which are sub-explanate. The abdominal plates

Digitized by Google

nearly reach the apex of the basal segment, and are very sparingly punctulate. The flattened ridge of the prosternum (which, however, is scarcely so much flattened as usual) is parallel-sided. The pubescence scarcely differs from that of *R. Evansi*.

Port Lincoln; not common. An abraded specimen from near Lake Eyre seems to be identical, but its condition will not allow of certainty.

R. Lindi, sp. nov. Ovalis; sat convexus; pubescens; sat nitidus; piceus, antennis, palpis, corpore subtus, pedibusque, plus minus rufescentibus; prothorace quam longiori vix duplo latiori, elytris basi vix angustiori, antice vix angustato, lateribus subrectis, angulis anticis rotundatis, posticis distinctis obtusis; capite prothoraceque subtilius, elytris magis fortiter, sat crebre punctulatis; metasterno medio subtiliter transversim rugato sat distincte punctulato. Long., 1—1⅓ l.; lat. ⅔—1 l.

The abdominal plates are as in *R. insipidus*. The flattened ridge of the prosternum is strongly narrowed from its base to the front, where it is truncate. The pubescence scarcely differs from that of *R. Evansi*. Nearest to *R. insipidus*, from which its puncturation, though not quite so strong, scarcely distinguishes it. It is, however, a wider and shorter insect, more strongly rounded on the sides, differently coloured, and especially with the prosternal ridge wider and truncate in front. It is smaller, very much more feebly punctured, and more obscurely coloured than *R. Evansi*, and differs from *R. debilis*, *inter alia*, in its stronger puncturation and prosternal ridge narrowed to the front.

Port Lincoln.

R. ruficollis, sp. nov. Ovalis; sat convexus; pubescens; nitidus; subtus ferrugineus; capite, prothorace, pedibusque læte rufis; prothorace quam longiori paullo minus duplo latiori, elytris basi vix angustiori, antice parum angustato, lateribus parum arcuatis, angulis anticis rotundatis, posticis subrectis; capite prothoraceque subfortiter, elytris paulo magis fortiter minus crebre punctulatis; metasterno medio transversim rugato subfortiter punctulato. Long., 1⅓ l.; lat., ⅘ l.

The abdominal plates are about three-fourths the length of the basal segment, and are punctured much more strongly and sparsely than the sides of the segment. The prosternal ridge is as in *R. insipidus*. The pubescence resembles that of *R. Evansi*, but the longer erect hairs are even longer and stouter than in that species.

Very differently coloured from all the preceding, and distinguished from all but *R. insipidus* by the sharply-pointed prosternal ridge. From the latter it differs in the pubescence, the

Digitized by Google

shorter abdominal plates, more strongly sculptured metasternum, rather more sparing puncturation of the upper surface where there is less difference, moreover, than usual in the genus between the punctures on the prothorax and those on the elytra, and in the dark elytral epipleuræ (those of *R. insipidus* show up as of a pale brown colour in strong contrast to the reddish pitchy metasternum and hind body), besides other differences of colour, &c.

Port Lincoln.

R. ventralis, Er. I have taken near Port Lincoln, and also near Adelaide, examples of an insect which I cannot doubt is this remarkably coloured species, but if so, it is desirable to point out that Erichsen is in error in calling it "oblongo-ovalis," as it is rather exceptionally wide. It is, of course, possible that I have not the genuine thing before me, but my specimens agree perfectly with the description in every character except that I have named, including the unusual character of having the anterior angles of the prothorax membranous. Mulsant uses a similar expression in his (apparently independent) description, but afterwards furnishes measurements that certainly do not justify it, but show the species to be of much broader proportions than others to which he applies the same term.

The insect before me is rather unlike *Rhizobius* in facies, but does not differ structurally in any respect so far as I can discover.

Since many of the species of this first section of *Rhizobius* are closely allied *inter se*, the following tabulation may be serviceable:—

A. Elongate subparallel species.
  B. Prothorax and elytra brown or ferruginous. *discolor*, Er.? (var. *proprius*, Blackb.)
  BB. Prothorax and elytra cyaneous. *cyaneus*, Blackb.
AA. Oval species.
  B. Upper surface clothed with long erect hairs as well as short pubescence.
    C. Prosternal ridge sharply pointed in front.
      D. Epipleuræ of elytra dark coloured. *ruficollis*, Blackb.
      DD. Epipleuræ of elytra pallid (in contrast with the much darker under surface of body). *insipidus*, Blackb.
    CC. Prosternal ridge not sharply pointed in front.
      D. Elytra strongly punctulate (more strongly than those of *R. liturus*, Fab.) *Evansi*, Muls.
      DD. Elytra very finely punctulate; prosternal ridge with parallel sides. *debilis*, Blackb.
      DDD. Elytra distinctly but not very strongly punctulate; prosternal ridge narrowed forward. *Lindi*, Blackb.

Digitized by Google

BB. Upper surface evenly pubescent. *læticulus*, Blackb.

AAA. Form ovate; under surface black, except ventral segments, which are bright red. *ventralis*, Er.

AA. Prosternum antice æqualiter convexum, longitudinaliter neccarinatum nec sulcatum.

B. Species majores.

In this group the intercoxal portion of the prosternum is more or less carinate laterally but the part in front of the coxæ is simply convex with more or less tendency to be compressed, especially in the extreme front, owing to which the middle of the front margin is more or less angularly prominent. The eyes are extremely coarsely granulated and placed very obliquely.

R. australis, sp. nov. Oblongo-ovalis; subparallelus; minus convexus; sat nitidus; pubescens; rufus, elytris (margine laterali sat anguste rufo excepto) piceo-nigris; capite prothoraceque subtiliter sat crebre, elytris fortius subrugulose, punctulatis. Long., $2\frac{3}{5}$ l.; lat., $1\frac{2}{5}$ l.

The red lateral margin of the elytra is not very sharply defined or conspicuous; it is continued round the apex where it is a little dilated. The pubescence of the upper surface is uniform (*i.e.*, not containing hairs conspicuously longer and more erect than the rest). The third joint of the antennæ is as long as the following two together; the ninth and tenth joints are transverse and have their inner apex produced in a kind of lobe which is curved forward against the basal part of the next joint. The prothorax is quite twice as wide as long, widest at the base which is more than half again as wide as the front margin, the latter moderately emarginate with angles quite rounded off; the sides converge slightly from the base to about the middle, thence roundly and more strongly. On the underside the puncturation is fine and close on the sides (and almost effaced in the middle) of the meso and meta-sterna, fine and close on the sides (and very sparing in the middle) of the ventral segments; the abdominal plates are about five-sixths the length of the basal segment and are punctured more sparsely than the adjacent surface; the mesosternum is quite a third as long as the metasternum, and is not emarginate in front; the prosternum is rather wide and flat between the coxæ with its sides parallel and finely keeled, its anterior (and longer) portion being evenly and rather strongly convex; the angular prominence of the anterior margin of the prosternum is extremely feeble. The widest part of the prothorax is five-sevenths of the width of the widest part of the elytra. The claws are appendiculate, but the inner apex of the basal piece is sharp and tooth-like. The middle of the hind margin of the basal ventral segment is roundly and widely (but

Digitized by Google

rather conspicuously) produced backward over the second segment, in all the specimens I have seen.

Near Adelaide; also taken by Mr. J. G. O. Tepper on Kangaroo Island.

R. subfusca, sp. nov. Oblongo-ovalis; minus parallelus; sat nitidus; pubescens; rufo-fuscus; prothorace elytrisque nigricantibus; capite prothoraceque fortius, elytris magis etiam fortiter, crebre punctulatis. Long., $2\frac{1}{5}$ l.; lat., $1\frac{1}{5}$ l.

The whole under surface is of a somewhat fuscous red colour—the antennæ palpi and legs red rather than fuscous—the upper surface (except the head and anterior angles of prothorax which are reddish) is very dark fuscous. The pubescence is uniform. The antennæ are as in *R. australis*. The prothorax is not more than a third again as wide as it is long down the middle. In other respects the prothorax resembles that of *R. australis* except that it is more evenly narrowed from the base to the apex. The whole undersurface is strongly punctured, the puncturation being very coarse and not close on the prosternum and thence gradually finer and closer hindward till on the apical ventral segment it is very fine and very close. The abdominal plates are hardly three-fourths the length of the basal segment and are punctured rather more coarsely and sparsely than the adjacent surface. The mesosternum resembles that of *R. australis* except that it is very gently and roundly emarginate in front. The prosternum is nearly parallel sided between the coxæ, but hardly distinctly carinate on its margins; in front of the coxæ it is strongly compressed with the angular prominence in the middle of its anterior margin very strong. The greatest width across the elytra is half again the greatest width of the prothorax, though the true base of the former is hardly wider than the base of the latter. The hindward curve of the hind outline of the basal ventral segment is scarcely apparent. The eyes are very coarsely granulated but scarcely so oblique as in *R. australis*.

Adelaide.

N.B.—Although this species differs strongly from the preceding, in many respects its structural differences appear to be only in degree. The prosternum makes a distinct approach towards that of *Cryptolæmus* from which its appendiculate claws, coarsely facetted eyes, &c., distinguish it. It is quite possible that it may eventually have to be distinguished generically from *R. australis*.

R. xanthura, Muls. Specimens in my own and other collections, taken near Mount Gambier, on Kangaroo Island, and other places, evidently pertain to this species. The following particulars are not mentioned in M. Mulsant's description:—Puncturation of the upper surface very close and rather fine,

Digitized by Google

but strong (a little finer on the prothorax than on the elytra); prosternum as in *R. australis* but anteriorly a little less convex.

**R. major*, sp. nov. Ovalis; minus convexus; sat æqualiter pubescens; sat nitidus; ferrugineo-rufus, elytris (apice anguste rufa excepta) picescentibus; prothorace quam longiori plus duplo latiori, antice leviter angustato, angulis anticis rotundatis, posticis subrectis; capite prothoraceque sat crebre, elytris minus crebre, leviter punctulatis. Long., $2\frac{3}{5}$—$3\frac{1}{5}$ l.; lat., $1\frac{3}{5}$—$2\frac{1}{5}$ l.

The abdominal plates are a little more than two-thirds the length of the basal segment; they are punctured finely and closely (like the adjacent surface), and also bear some large sparse punctures. The flattened ridge of the prosternum is narrowed from its base to the front, which is rounded. The underside is closely and finely punctured laterally, the metasternum being nearly impunctate in the middle—the ventral segments in the middle more coarsely and less closely punctured than at the sides.

A large robust species bearing much superficial resemblance to my *R. australis*—from which it differs (apart from the structure of the prosternum) in its generally superior size and robustness, the stoutness of its tarsi, and in the epipleuræ of the elytra being dark piceous, whereas in every specimen that I have seen of *R. australis* they are of a bright ferruginous colour, concolorous with the general surface of the underside. The pubescence, moreover, is of a rich golden brown, and in *R. australis* is pale brownish white.

Fowler's and Streaky Bay. In my collection; also taken by Prof. Tate.

BB. Species minores. Oculi minus obliqui.

R. nitidus, sp. nov. Sat breviter ovalis; convexus; pubescens; nitidus; ferrugineo-piceus; antennis, palpis, pedibus, prothorace antice, prosterni lateribus, et elytrorum epipleuris dilutioribus; prothorace quam longiori duplo latiori, antice angustato, angulis anticis rotundatis, posticis subrectis; capite elytrisque leviter sparsim (his postice fortius), prothorace vix perspicue, punctulatis. Long., $\frac{4}{5}$ l.; lat., $\frac{3}{5}$ l.

The abdominal plates are hardly two-thirds the length of the

---

* This description I have accidentally misplaced in the memoir; it should follow the description of *R. cyaneus* on p. 200. Owing to this accident I have also omitted the species from the tabulation on p. 203 of species with the prosternum longitudinally flattened. In the tabulation *R. major* would fall among the oval species but is distinct among them by its much greater size and other characters.

Digitized by Google

basal segment, and are punctured much in the same way as the adjacent surface. The prosternum is evenly convex longitudinally, and its front margin is not in any noticeable manner angularly prominent in the middle. The underside is finely punctulate—more closely at the sides than in the middle. The few specimens that I have seen of this insect are unfortunately much abraded, but I think there is no doubt that in a fresh specimen the pubescence of the upper surface is tolerably close and even, and of a silvery white colour.

Apart from the great difference in the structure of the prosternum, this species has the superficial aspect of a liliputian *R. debilis*.

Port Lincoln.

R. occidentalis, sp. nov. Ovalis; sat convexus; pubescens; vix perspicue punctulatus; nitidus; lurido-testaceus; elytrorum epipleuris pallide flavis, macula basali communi triangulari, sutura, linea communi arcuata post medium, et maculis aliis parvis nonnullis, piceis; prothorace quam longiori vix duplo latiori, antice minus angustato, angulis anticis rotundatis, posticis subrectis. Long., $\frac{4}{5}$ l.; lat., $\frac{3}{5}$ l. (vix).

The abdominal plates and prosternum seem scarcely different from the corresponding parts in *R. nitidus*. Under a powerful Coddington lens there is little defined sculpture visible on the undersurface, except on the ventral segments, where (especially in the middle) some sparse rather fine puncturation can be discerned.

In the unique example that I possess of this insect the prothorax is a little stained with piceous in the middle; on the elytra the fuscous stains consist of a rather broad sutural line, which is crossed near the apex by a short curved line (its convexity hindward) and dilates close to the front into a large triangular patch including the scutellum, but not quite including the humeral calli, and also some small slightly defined spots on the disc.

Western Australia; taken by E. Meyrick, Esq.

R. speratus, sp. nov. Breviter ovalis; pubescens; crebre minus subtiliter punctulatus; fusco-testaceus; elytris anguste piceo-marginatis, postice signatura communi curvata picea instructis—hac cum sutura picescente ancoram simulante. Long., $\frac{4}{5}$ l. (vix); lat., $\frac{3}{5}$ l (vix).

The puncturation is about as fine as in *S. flavifrons*, but is somewhat closer, and there is no appearance whatever of asperity. The dark fuscous markings of the elytra are all narrow, and make up a very accurate representation of an anchor. There is an additional (but very faintly defined) fuscous line joining the extremities of the flukes of the anchor; if this line be taken

Digitized by Google

into account the resemblance to an anchor is, of course, less noticeable.

Rather closely resembling the preceding superficially, but different in respect of the markings (which do not seem to be variable) and of the puncturation of the upper surface, which is very much closer and better defined. Compared with *R. nitidus* the puncturation is much finer, closer, and more even.

Three specimens occurred to me in the Lake Eyre basin, interior of South Australia.

R. approximatus, sp. nov. Breviter ovalis; sat convexus; pubescens; nitidus; piceus, vix ferrugineus; antennis palpis pedibusque vix dilutioribus; elytrorum epipleuris pallide brunneis; prothorace quam longiori duplo latiori, antice angustato, angulis anticis rotundatis, posticis subrectis; capite subtilius sat sparsim, prothorace vix perspicue, elytris duplo, punctulatis. Long., $\frac{4}{5}$ l. (vix); lat., $\frac{3}{5}$ l.

Unsatisfactorily close to *R. nitidus*, but presenting characters that seem to indicate a distinct species. The slightly shorter, wider, and less convex form is accompanied by a considerable difference of colour, the whole insect being pitchy black, with scarcely any ferruginous tendency (except the feebly reddish tarsi and the pale brown epipleuræ). The puncturation of the elytra, too, is distinct. In *nitidus* it is very faint near the scutellum but grows much stronger laterally and apically (where it is even, rather strong and by no means close), while in the present species the whole surface (even close to the scutellum) is very distinctly and rather closely though finely punctulate, this system of uniform puncturation becoming mingled towards the side and apex with a much more sparse system of much coarser puncturation.

Port Lincoln.

R. umbratus, sp. nov. Breviter ovalis; sat convexus; pubescens; sat nitidus; subtiliter sat crebre punctulatus; fuscus, antennis palpis pedibusque testaceis; elytris obscure testaceo-notatis; meso- et meta-sternis plus minus picescentibus; prothorace quam longiori duplo latiori, antice leviter angustato, angulis anticis subrotundatis, posticis subrectis. Long., $\frac{4}{5}$ l. (vix); lat., $\frac{3}{5}$ l.

The upper surface is marbled or clouded with pale brown and yellowish testaceous in a vague and somewhat intricate manner difficult to describe accurately. In a well-marked specimen the prothorax is brownish testaceous, cloudily darker along the front and base, while the elytra are of a full fuscous colour, with large cloudy testaceous markings consisting of an oblique fascia (much abbreviated at both ends and angulated behind) near the front, and an obscure spot on either side of the suture behind the

Digitized by Google

middle, the lateral margins and apex being also testaceous. In some examples the testaceous colour of the apex is intensified in the middle in such manner that it appears as a distinct oblique line of almost vivid yellow; but the markings shade off into the ground colour so vaguely that they present a different appearance according to the position from which the insect is looked at. On the underside the prevailing colour is reddish brown with the breast darker, against which the pale testaceous epipleuræ of the elytra show up very conspicuously. The puncturation of the upper surface differs from that in *R. nitidus* and *R. approximatus* by its much more even distribution—the prothorax being punctured almost uniformly with the elytra—and from that in *R. speratus* by its being slightly stronger and less close.

Port Lincoln; also near Adelaide.

SERANGIUM, *gen. nov.*

Caput prothoraci profunde insertum; antennis 11 articulatis, clava magna, basi aperta; oculi oblongi, sat fortiter granulati, intus subparalleli vel potius leviter antice convergentes; epipleuræ sat angustæ, postice angustatæ, concavæ, elytrorum in parte quarta postica obsoletæ, contra pedes intermedios et posticos profunde foveatæ; prosternum antice sat elongatum, sat æqualiter convexum, in medio longitudinaliter nec carinatum nec depressum, ad pedum receptionem profunde utrinque excavatum; mesosternum breve fortiter transversum, antice truncatum; abdomen segmentis 5 (basali et apicali inter se subæqualibus) conformatum; suturæ ventrales bene impressæ; sterna utrinque ad pedum intermediorum et posticorum receptionem late profunde excavata; lamellæ abdominales segmenti basalis apicem attingentes, hujus cum margine apicali postice confusæ; tibiæ et femora valde compressa; hæc in facie inferiori ad illarum receptionem canaliculata; unguiculi appendiculati.

The combination of the following characters places this genus in the group *Bucolites* of Dr. Chapuis, viz.:—body pubescent, base of antennæ exposed, elytral epipleuræ with well-defined foveæ. Among the *Bucolites* the following combination will distinguish it, viz.:—ventral segments only five, abdominal plates incomplete, prosternum excavated to receive the front legs, tibiæ not dentate externally. It is also distinguished from all other genera of *Coccinnellidæ* known to me by the structure of the legs, which have all their femora sulcate down the middle of their flat under surface for the reception of the tibiæ, in such fashion that when the femora are reposing in their cavities the tibæ and tarsi are entirely hidden beneath them, and each leg exactly filling its cavity, the general surface is quite level. In the example before

Digitized by Google

me the head is drawn into the cavity of the prothorax so closely and exactly that the front margin of the epistoma is in contact along its entire length with the front margin of the prosternum, and the oral organs (except the antennæ) are completely hidden; the structure in this respect resembling that of *Cryptolæmus*.

S. mysticum, sp. nov. Late ovale; sat convexum; nitidum; ferrugineum, piceo-umbratum; longe nec crebre albido-pubescens; supra fere impunctatum; subtus segmentis ventralibus antice subtiliter sparsim, postice crebrius subrugulose, punctulatis. Long., $1\frac{1}{5}$ l (vix); lat., $\frac{4}{5}$ l.

The general colour is a deep reddish-brown, the head and thorax pitchy, the general colour clouded vaguely with piceous about the suture and margins of the elytra and on the breast. The prothorax is rather small in proportion to the elytra; it is quite twice as wide as long; its front margin is sinuated behind the eyes; its sides are strongly rounded (somewhat angulated in the middle), and all its angles are rounded off; a delicate impressed line runs immediately in front of the hind margin. The superficial appearance is that of *Scymnus*. Under a very strong lens the prothorax shows some excessively fine puncturation; I cannot discover any on the elytra without using a microscope.

Port Lincoln; under bark of *Eucalyptus*.

BUCOLELLUS, *gen. nov.* [Bucolo affinis].

Corpus pubescens; caput prothoraci mediocriter insertum; antennarum brevium basis aperta; oculi sat magni, sat subtiliter granulati, intus subparallela; epipleuræ antice sat latæ subhorizontales, postice gradatim angustatæ et magis verticales, contra pedes intermedios et posticos profunde foveatæ; prosternum breve, sat æqualiter convexum, in medio longitudinaliter nec carinatum nec depressum; mesosternum sat magnum, antice truncatum; abdomen segmentis 5 (apicali præcedentibus 2 conjunctis longitudine æquali) conformatum; suturæ ventrales bene impressæ; lamellæ abdominales segmenti basalis apicem attingentes, hujus cum margine apicali postice confusæ; femora minus compressa; tibiæ sat graciles; unguiculi appendiculati.

This genus is certainly, I think, near to *Bucolus*, from which it differs chiefly in the shorter antennæ,* in the incomplete ventral lamellæ, and especially in the exceptionally short prosternum, this being in *Bucolus* exceptionally long.

B. ornatus, sp. nov. Breviter ovalis; pubescens; sat convexus;

* I have examined these under a microscope as well as possible without injury to the type, and find that they appear to consist of ten joints, but it is not possible to be quite certain without examination under more favourable conditions.

Digitized by Google

nitidus; ferrugineo-piceus; antennis, palpis, pedibus, prothoracis lateribus, et elytrorum signis nonnullis, testaceis; prothorace leviter sat crebre, elytris sparsius fortius, corpore subtus (segmento ventrali apicali excepto, hoc subtilius crebre subrugulose), punctulatis. Long., 1 l. (vix); lat., $\frac{4}{5}$ l. (vix).

The testaceous markings on the elytra are complicated and ill-defined, and probably variable. In the example before me on either elytron a wide vitta commences close to the humeral callus and runs obliquely towards the suture, but before reaching it turns hindward and runs parallel to the suture to a little distance short of the apex, where it becomes merged in the wholly testaceous colour of that part; in its hinder half its internal edge is bi-emarginate in such fashion that the dark sutural portion of the elytra appears to be twice dilated in its hinder half, and as a whole presents somewhat the outlines of a wineglass with a broad stem. On its external side the testaceous vitta in the hinder half is indeterminately dilated almost to the lateral margin, but some portion of this dilated portion is darker than other portions, so that there seems here to be a testaceous ground colour bearing some vaguely darker spots. The prothorax is about twice as wide as long; it is strongly emarginate in front, but not conspicuously sinuated behind the eyes; the sides are slightly rounded, the angles but feebly defined; the surface is more coarsely punctured near the lateral margins than in the middle.

A single specimen was sent to me from Western Australia by E. Meyrick, Esq.

BUCOLUS FOURNETI, *Muls.*

This species, omitted in Mr. Master's catalogue, although described originally on specimens stated to have been taken in Australia, is common in the neighbourhood of Adelaide. I have also taken it in the Port Lincoln district and in the Lake Eyre basin in the interior.

LIPERNES, *gen. nov.* (Bucolo affinis).

Corpus pubescens; caput prothoraci mediocriter insertum; antennarum basis haud aperta (?); clypeus cum genis superficiem ante oculos extensam efficiens; oculi magni subtiliter granulati, intus subparalleli; epipleuræ sat angustæ, postice gradatim angustatæ, apicem vix attingentes, contra pedes intermedios et posticos profunde foveatæ; prosternum antice sat breve, sat æqualiter convexum, in medio longitudinaliter nec carinatum nec depressum; mesosternum brevissimum (?) antice truncatum; abdomen segmentis 5 (basali et apicali inter se subæqualibus) conformatum; suturæ ventrales bene impressæ; lamellæ abdominales integræ

Digitized by Google

segmenti basalis apicem fere attingentes; pedes mediocres; tibiæ minus fortiter compressæ; unguiculi appendiculati.

The loss of the antennæ in my exponent of this genus is unfortunate; these members are very short, with the club proportionally large and the joints preceding the club very minute, so far I have been able to ascertain, but I destroyed the one antenna I had succeeded in distinguishing while trying to count the joints. There will, however, be no difficulty in identifying the genus without a detailed description of the antennæ. The clypeus and cheeks are continuous, and formed almost exactly as in *Orcus*. This character combined with the following will, I think, distinguish the genus from all hitherto named genera of *Coccinellidæ*, viz., anterior tibiæ simple, prosternum evenly convex in front of the anterior coxæ, ventral segments only five, body pubescent, epipleural foveæ very well defined, epipleuræ narrow (*e.g.*, much narrower than in *Bucolus*) and horizontal, legs not received in repose in sulci of the undersurface.

N.B.—I have not been able to satisfy myself as fully as I could wish regarding the structure of the mesosternum; indeed, I have failed to detect any suture between the meta and mesosterna under a fairly good microscope. It is just possible that an excessively fine suture may have escaped my observation, but I think it more probable that the suture is in contact with the hind margin of the prosternum, the mesosternum thus being (in part at least) vertical, and only observable by dissection. There is some approximation to such a structure in *Serangium* and other genera of *Coccinellidæ* where only a very short transverse strip of mesosternum is visible without dissection.

L. angulatus, sp. nov. Late ovalis; sat convexus; nitidus; piceo-niger, apicem versus obscure dilutior; capite prothoraceque subtiliter crebre, elytris paullo fortius sparsius, punctulatis. Long., 1 l.; lat., $\frac{4}{5}$ l. (vix).

The whole body is of a nearly uniform pitchy black colour, the elytra slightly paler towards the apex (perhaps only in occasional examples). The prothorax is about twice as wide as long, its sides very strongly deflexed so as to be almost vertical; the front margin is sinuated behind the eyes; its sides are but little rounded; its front angles though not at all sharp are fairly defined and rather prominent, its hind angles roundly obtuse; the base bears a fine impressed line close within the margin and is strongly convex (or widely lobed) all across the middle, being somewhat angular in front of the scutellum; the puncturation of the surface becomes coarser and subrugulose near the lateral margins where it is perhaps a little stronger than that of the

Digitized by Google

elytra. The pubescence is silvery, short, and sparse, but my example is certainly more or less abraded.

Near Port Lincoln. Obtained by sweeping low plants.

CYREMA, *gen. nov.* [Cryptogono affinis].

Caput prothoraci mediocriter insertum; antennarum basis aperta; oculi magni, minus subtiliter granulati, intus subparalleli; epipleuræ minus latæ, subverticales, postice gradatim angustatæ, contra pedes intermedios et posticos sat profunde foveatæ; prosternum inmedio longitudinaliter depressum, utrinque ad pedum receptionem excavatum; mesosternum transversum sat magnum, antice truncatum; abdomen segmentis 5 (basali et apicali longitudine inter se subæqualibus) conformatum; suturæ ventrales bene impressæ; sterna utrinque ad pedum intermediorum et posticorum receptionem excavata; lamellæ (abdominales segmenti basalis apicem attingentes, cum margine apicali postice confusæ) valde conspicuæ, concavæ; femora fortiter compressa; tibiæ minus validæ, anticis fortiter arcuatis.

The antennæ are very short, but I have completely failed to arrive at any certainty as to the details of their structure, so it is better to say nothing about them.* There is very little pubescence on my two specimens; probably, however, they both are more or less abraded. The genus would seem to be allied to several already described, but very distinct from all. The concave lamellæ of the under surface with their margins very strongly in relief, in the concavities of which the legs are contractile, together with the foveated elytral epipleuræ and the great development of the abdominal lamellæ, are suggestive of *Cryptogonus*, but on the other hand the mesosternum is well developed, and the ventral segments are only five in number. The form of the prosternum with a flattened longitudinal median space strongly narrowed from base to front, in combination with the characters mentioned above, will distinguish this genus from all others known to me. The claws are feebly appendiculate, and rather large.

C. nigellum, sp. nov. Late ovale; valde convexum; nitidum;

* The antennæ of some *Coccinellidæ* are very difficult to examine; owing to their minuteness and their concealed position it is often impossible even to break them off from a dry specimen successfully for microscopic study. Dr. Chapuis (Gen. Col. xii., p. 239) speaks of having uselessly sacrificed his unique example of *Cryptogonus* in the hope of furnishing information concerning the antennæ which the author of the genus had been unable to supply. I have to deplore a similar result of my study as regards one of my two specimens of *Cyrema*, and my unique exponent of *Lipernes* is none the better for my explorations in the region of its antennæ.

Digitized by Google

nigrum vel piceo-nigrum; capite prothoraceque subtiliter sat crebre, elytris multo fortius minus crebre, punctulatis. Long., $\frac{7}{10}$ l.; lat., $\frac{6}{10}$ l. (vix).

The head is wide, and flat between the eyes. Viewed from above the insect has quite the appearance of a *Chilocorus*. The prothorax is considerably longer down the middle than at the margins; across the base its width is more than twice its length down the middle; the front margin is strongly sinuous behind the eyes; the sides are widely, though very slightly, reflexed; the front angles are rounded, the hind angles obtuse. On the under side the meso-and meta-sterna are very finely and obscurely, and the ventral segments finely, closely, and strongly, punctured. The lamellæ under a powerful Coddington lens appear punctureless.

Two specimens occurred to me near Port Lincoln.

Digitized by Google

On the Occurrence of Coal Detritus in the Valley of the Murray.

By Walter Howchin, F.G.S.

[Read October 2, 1888.]

ABSTRACT.

The locality referred to is in the Hundred of Angas, about half a mile north of the South Rhine and three miles west from Rhine Villa. The superficial beds consist of alluvial brought down by the streams from the hills, which are but a quarter of a mile distant, the drift material being spread out as a low talus skirting the escarpment of the metamorphic rocks. The fragments of coal were first discovered at the surface, and were picked up in dry watercourses which had been cut in the superficial gravel beds. These fragments were noticed both in the loose material of the creek bottoms and also exposed in section of gravel beds along the two sides of the main creek.

The surface alluvium rests upon clay beds of much older date. There is first in descending order a reddish mottled clay about five feet in thickness, and beneath the latter a yellowish sandy clay of very uniform character and of considerable thickness. Messrs. Stoeckel brought up small fragments of coal from a bore in this clay at a depth of 80 feet, and the author found unmistakeable evidence of the presence of coal and carbonaceous shale at a depth of 110 feet, in a shaft sunk about 200 yards nearer the hills than the above-mentioned bore. This thick clay, in which the coal fragments occur, is apparently of lacustrine origin and of Tertiary age, and has been bared by the local streams after cutting through the superficial gravels.

The fragments of a carbonaceous character are mostly small, subangular, and of good quality. The shale, carrying strings of coal freely, bears a close resemblance to the coal shales of the Hunter River district, New South Wales. The appearance, which these coaly fragments present, indicates that they have travelled no great distance from the parent rock, which may be reasonably looked for within the limits of the Murray Valley. The depression of the valley of the Murray is no doubt of great geological antiquity, and whatever formations may have been deposited in this great depression since the early Primaries were raised and contorted (supposing that they were not entirely denuded prior to

Digitized by Google

the deposition of the Tertiaries), have been preserved from the effects of denudation by thick horizontal beds since the beginning of the Tertiary period.

The presence of rocks of intermediate age in Western Victoria is suggestive of the possibility of their extension under the great Tertiary plains of the Murray, whilst the existence of numerous inliers of granite, running in a line from the Murray Bridge to the Victorian border, may mark the course of an old ridge of Archæan rocks that acted as a barrier to the force of the sea, limiting the power of marine denudation in its effects upon the country lying to the north and east of this line. Provided the coal measures were deposited in the old archæan valley of the Murray, a barrier to seaward, such as that indicated, must have proved an important physical feature in favour of their preservation.

The conclusions, so far as they can be stated in relation to this interesting question, are as follows:—1. The presence of coal detritus in alluvial beds of an undisturbed character within the Murray basin cannot be doubted. 2. The carbonaceous fragments are not proper to the bed in which they are found; their lithological character and subangular shape prove them to be transported material dislodged from formations of an older date. 3. If the clay-bed in which the coal drift occurs be of Older Tertiary age (as supposed), it is extremely improbable that the fragments in question, which were highly mineralised when first washed into their present position, could be of so recent an age as Tertiary. 4. The proximity of rocks of coal-bearing age in Victoria, on the eastern boundaries of the great tertiary plain, points to a probable extension of these formations to the westward. 5. No hypothesis that would account for the presence of coal-wash in such a position is credible, except the supposition that these fragments have been derived from rocks of a like character *in situ*, which probably occur in patches of greater or less extent beneath the superficial formations, and will probably be found at no great distance from the spot where the first indications have been discovered. 6. So far as can be judged from small and somewhat weathered specimens, the coal, if found, is likely to be of commercial value should it occur in sufficient quantities.

Digitized by Google

List of Fungi Named by Dr. M. C. Cooke,

From Dried Specimens Collected near Lake Bonney by Miss Wehl, and from Coloured Drawings Prepared by her.

[Communicated by Baron Sir F. von Mueller, M.D., F.R.S., &c.]

Agaricus (Amanita) muscarius, *Fr.*
" (Lepiota) obclavatus, *C.* and *M.*
" (Lepiota) columbicolor, *C.* and *M.*
" (Armillaria) melleus, *Fr.*
" (Tricholoma) rutilans.
" (Tricholoma) melaleucus, *Fr.*
" (Clitocybe) infundibuliformis, *Fr.*
" (Collybia) veluticeps, *C.* and *M.*
" (Collybia) tylicolor, *Fr.*
" (Mycena) sanguinolentus, *Fr.*
" (Mycena) ætitus, *Fr.*
" (Mycena) speireus, *Fr.*
" (Mycena) hiemalis, *Fr.*
" (Omphalia) muralis.
" (Pleurotus) polychromus, *C.* and *M.*
" (Entoloma) læticolor, *C.* and *M.*
" (Entoloma) Bloxanii, *B.*
" (Entoloma) melaniceps, *C.* and *M.*
" (Clitopilus) cancrinus, *Fr.*
" (Flammula) vinosus, *Fr.*
" (Flammula) sapineus, *Fr.*
" (Flammula) fusus, *Fr.*
" (Flammula) crociphyldus, *C.* and *M.*
" (Galera) conocephalus, *Bull.*
" (Psalliota) coronillus, *Bull.*
" (Crepidotus) mollis, *Fr.*
" (Crepidotus) epigæus, *Batsch.*
" (Psathyrella) trepidus, *Fr.*
Boletus australis, *C.* and *M.*
Clavaria flava, *Fr.*
Peziza vesiculosa, *Fr.*
Scleroderma vulgare, *Fr.*
Geaster floriformis, *Vitt.*
Coprinus plicatilis, *Fr.*
Cantharellus politus, *C.* and *M.*

Digitized by Google

ABSTRACT OF PROCEEDINGS

OF THE

Royal Society of South Australia,

FOR 1887-88.

ORDINARY MEETING, NOVEMBER 1, 1887.

Prof. RENNIE in the chair.

BALLOT.—W. J. Phillipson was elected a Fellow.

EXHIBITS.—Mr. A. MOLINEUX showed an abnormal growth of a fungus.

PAPER.—"Drainage of Adelaide, and its Influence upon the Death-rate," by Dr. JAMIESON (Melbourne). A discussion followed, in which Drs. Whittell, Davies, Thomas, and Poulton, and Messrs. D. Gall, D. J. Adcock, and Prof. Rennie took part. It was moved, seconded, and carried that a special vote of thanks be conveyed to Dr. Jamieson. Prof. Rennie said that he considered it important that a record of the total number of typhoid cases, stating localities in which they had arisen, should be kept, and not alone of the deaths which occur.

ORDINARY MEETING, DECEMBER 6, 1887.

Prof. RENNIE in the chair.

BALLOT.—William Grasby was elected a Fellow.

EXHIBITS.—J. G. O. TEPPER, F.L.S., showed a number of galls and various fungi found upon eucalypts and other trees. By A. ZIETZ, very rare night lizard (*Nephrurus platyurus*); brown snake, which he believed to be *Diemenia microlepidota* (McCoy), from Sedan, caught by R. Rothe, first specimen found in the province; specimen of *Lygosoma Lissneurii*, from the Murray Scrub.

PAPER.—"Drainage of Adelaide and its Influence on the Death-Rate: a Reply," by H. T. WHITTELL, M.D. Dr. JAMIESON forwarded a note.

Digitized by Google

ORDINARY MEETING, MARCH 4, 1888.

W. HOWCHIN, F.G.S., in the chair.

BALLOT.—W. T. Angove, M.R.C.S., was elected a Fellow.

EXHIBITS.—By A. ZIETZ, natural history specimens obtained during a trawling expedition in the Gulfs of St. Vincent and Spencer on board H.M.S. Protector. By J. G. O. TEPPER, a number of gem stones. By D. B. ADAMSON, photographs of the moon, these being the first taken in South Australia. By W. HOWCHIN, F.G.S., some *Polytrema miniacea*.

PAPERS.—"List of Fungi from near Lake Bonney, S.A." (collected by Miss Wehl), by BARON F. VON MUELLER, K.C.M.G., &c., &c. "Nomenclature of the Australian Fauna," by Rev. THOS. BLACKBURN, B.A.

ORDINARY MEETING, APRIL 3, 1888.

Prof. RENNIE in the chair.

EXHIBITS.—J. G. O. Tepper, F.L.S., various specimens of natural history.

PAPER.—"Surface Features and Rocks of Nuriootpa and its Neighbourhood," by J. G. O. Tepper, F.L.S.

ORDINARY MEETING, MAY 1, 1888.

Prof. RENNIE in the chair.

EXHIBITS.—By A. Zietz, further collection of specimens from the dredging expedition on board H.M.S. "Protector;" *Typanocryptus pictus* from Port Lincoln. By Prof, Tate, F.G.S., micaceous rock, supposed to be the matrix of the gems found by the "Maud River Ruby Company." By Geo. Francis, a chart of spectroscopic lists of precious stones. By A. Molineux, oil made from the *Eucalyptus cneorifolia* and *Melaleuca uncinata*. By J. G. O. Tepper, F.L.S., binoxide of manganese from the Burra; a fibrous mineral from the Tasmanian tin-field.

PAPER.—"The Composition of some so-called Australian Rubies," by Prof. RENNIE, Sc.D., F.L.S.

ORDINARY MEETING, JULY 3, 1888.

Prof. RENNIE in the chair.

A letter from the Hon. Sec. (Prof. Liversidge) to the Australasian Association for the Advancement of Science was read, notifying that the date of holding the first General Meeting had been altered from September 4 to August 28, 1888.

EXHIBITS.—By A. ZIETZ, *Scorpæna bellicosa* (Castelnau), from St. Vincent's Gulf, previously known only from Nichol Bay,

Digitized by Google

Queensland; thus making the third species of *Scorpœna* for South Australia, namely *S. cruenta*, *S. panda*, *S. bellicosa*. *Pentorage marmorata*. *Brachyiorophis*, sp. (?), from Port Augusta, possessing a large rostral shield, with a sharp anterior edge and a markedly short tail. *Hoplocephalus Gouldii*, from Port Augusta, being the first specimen with proper locality recorded for South Australia (Macleay's "Census for Australian Snakes" gives West Australia as the habitat). *Xanthosia murigena* (found in the pearl oyster), from Western Australia. *Harpilius*, sp. (?) (a small crustacean found domiciled in a pearl oyster), with rostrum rounded and smooth above, instead of being serrated as in other long-tailed crustaceans. *Periophthalmus Roelrentheri*, from Western Australia (a new locality). Abnormal form of a species of ray, without eyes or fins; species undetermined; presented by Mr. KEMP, Glenelg. Three remarkable sponges, from Western Australian pearling station, presented by Capt. REDDALL, namely *Tanthella australis*, *Tethyana ramosa*, *Reniera*, sp. (?). By J. G. O. TEPPER, F.L.S., collection of South Australian Apidoptera, comprising nearly all the known species; also a specimen of *Lebeda* (one of the *Bombycidæ*), which feeds upon eucalypts in the South-East of South Australia, and spins a very large cocoon, which might possibly be of commercial value.

PAPERS.—"Some New Coccidæ from South Australia," by W. M. MASKELL, New Zealand, communicated by Frazer S. Crawford; illustrated. A special vote of thanks was accorded to Mr. Maskell. "An Automatic River-Gauge," by THOMAS PARKER, C.E.

ORDINARY MEETING, AUGUST 7, 1888.

Prof. RENNIE in the chair.

BALLOT.—Oswald Lower was elected a Fellow.

PAPER.—"Sponges of Australia," by A. ZIETZ.

ORDINARY MEETING, SEPTEMBER 4, 1888.

Dr. WHITTELL in the chair.

BALLOT.—Mr. N. Maskell, New Zealand, was elected a Corresponding Member. Robert William Chapman, B.A., was elected a Fellow.

EXHIBITS.—By J. G. O. TEPPER, F.L.S., some mineral specimens. A rare fungus, forwarded by MISS HICKS. By W. T. ANGOVE, M.R.C.S., two honey eaters, namely, *Myzomela nigra* and *Dicœum hirundinaceum*.

PAPERS.—"List of Snake-like Lizards observed in South Australia," by A. Zietz. "Notes upon a New Australian Mammal," by E. C. Stirling, M.D.

W. B. Poole was elected Auditor.

Digitized by Google

ANNUAL MEETING, OCTOBER 2, 1888.

Prof. RENNIE in the chair.

Mr. Frazer Crawford introduced to the President Mr. Albert Koebele, the Assistant Entomologist for the United States of America, who was present as a visitor.

EXHIBITS.—By J. G. O. Tepper, F.L.S., a complete list of South Australian *Buprestidæ*. By Mr. D. J. Adcock, specimen of *Voluta Adcocki* from Encounter Bay.

The annual report and balance-sheet were read, adopted, and ordered to be printed.

The annual reports and balance-sheets of the Field Naturalists' and Microscopical Sections were read and accepted.

Mr. J. G. O. TEPPER, F.L.S., gave notice that at the next meeting of the Society he would move—"That the recommendations made by the Field Naturalists' Section with regard to the better protection of the native fauna and flora be adopted by this Society."

ELECTION OF COUNCIL.—The nomination and election of officers for the ensuing year was as follows:—President, Prof. Rennie, D.Sc., F.C.S.; Vice-Presidents, H. T. Whittell, M.D., and E. C. Stirling, M.D.; Hon. Treasurer, Walter Rutt, C.E.; Hon. Secretary, W. L. Cleland, M.B.; Members of Council, Prof. Tate, F.G.S., W. B. Poole, Charles Todd, C.M.G., M.A., W. Howchin, F.G.S., D. B. Adamson, Rev. Thos. Blackburn, B.A.

PRESIDENT'S ADDRESS.—Prof. RENNIE, D.Sc., gave an address on the "Relations between Chemical Science and some Colonial Industries."

PAPERS.—"On Australian Coleoptera, with Descriptions of New Species," by Rev. Thomas Blackburn, B.A. "On the Occurrence of Drift Coal in the Valley of the Murray," by W. Howchin, F.G.S. "Gastropods of the Older Tertiary of Australia, part II.;" "Additions to the Lamellibranchiata of South Australia, with Descriptions of New Species;" "Additions to the Flora of Port Lincoln;" "Plants of the Lake Eyre Basin;" "Definition of New Species of Plants;" "A Census of the Molluscan Fauna of Australia;" "Descriptions of New Genera and Species of Australian Mollusca," by Prof. Tate, F.G.S.

Digitized by Google

ANNUAL REPORT.

Tho Council has the pleasure of reporting that the work of the Society has been carried on successfully during the past year. The following papers have been laid before the Society :—"The deep drainage of the City of Adelaide and its influence on the death-rate of the city," by Dr. Jamieson, of Melbourne; "Reply showing certain fallacies in Dr. Jamieson's paper," by Dr. Whittell; "List of fungi collected near Lake Bonney by Miss Wehl," by Baron. v. Mueller; "On the Nomenclature of Australian Fauna," by Rev. Thos. Blackburn, B.A.; "Surface features of the District of Nuriootpa," by J. G. O. Tepper, F.L.S.; "On the composition of so-called 'Australian Rubies,'" by Prof. Rennie, D.Sc.; "Description of an automatic River Gauge," by Thos. Parker, C.E.; "On the Sponges of Australia," by A. Zietz; "List of Snake-lizards in South Australia," by A. Zietz; "Some new Coccidæ of South Australia," by W. M. Maskell, of New Zealand; "Description of a new mammal," by E. C. Stirling, M.D.; "On Australian Coleoptera, with descriptions of new species," by Rev. Thos. Blackburn, B.A.; "Gastropods of the Older Tertiary of Australia, Part II.," by Prof. Tate, F.G.S.; "Additions to the Lamellibranchiata of South Australia," by Prof. Tate, F.G.S.; "Additions to the Flora of Port Lincoln," by Prof. Tate, F.G.S.; "Plants of the Lake Eyre Basin," by Prof. Tate, F.G.S.; "Definitions of new species of Plants," by Prof. Tate, F.G.S.; "A Census of the Molluscan Fauna of Australia," by Prof. Tate, F.G.S.; "Description of new Genera and Species of Australian Mollusca," by Prof. Tate, F.G.S.; "Remarks on the Coal-drift on the Murray Flats," by W. Howchin, F.G.S.

During the year there have been presented to the notice of the Fellows and members many new and interesting exhibits of natural history, chiefly procured by J. G. O. Tepper, F.L.S., and A. Zietz. The Council has much pleasure in noticing that an attempt was made during the year to utilise the services of the S.S. "Protector" in dredging some of the deeper portions of the seas adjacent to our coasts. The results were eminently gratifying, as shown by some of the rare and unique specimens that have already been exhibited. It was also a matter for congratulation that these dredgings were under the scientific direction of Mr. A. Zietz, assisted by Dr. Stirling, who was fortunately able to accompany the expedition. Amongst other exhibits may be mentioned a night-lizard (*Nephrurus platyurus*) by A. Zietz; *Diemenia microlepidota* from Sedan, by A. Zietz, being the first

Digitized by Google

specimen known to occur in the Province. Photographs of the moon by D. B. Adamson, this being the first attempt to take them in South Australia. *Polytrema miniacea*, by W. Howchin, F.G.S. Portions of a new mammal found in Central Australia, by A. Zietz.

The membership of the Society consists of 120 Fellows, 11 Hon. Fellows, 15 Corresponding Members, and two Associates.

During the year five new Fellows have been elected and one Corresponding Member, W. M. Maskill, F.R.M.S. It is with much regret that your Council has to record the death of one of the most senior Fellows, namely, Mr. David Gall. Although Mr. Gall did not contribute much that was new to science to the Proceedings of the Society, yet he was a Fellow that the Society could ill afford to lose, for his attendance at the meetings was most regular, and his intelligent and sympathetic appreciation of all pertaining to science made his presence most encouraging to those who had exerted themselves to bring forward objects for description or exhibition. In the promptness and regularity with which Mr. Gall paid his annual subscriptions, it is evident that he looked upon this act as one of the most important pertaining to the duties of a Fellow, recognising the fact that it is only by this means that much costly and invaluable scientific work can be perpetuated in the scientific proceedings of a learned society.

On this account your Council has viewed with much concern the receipt of numerous resignations of Fellows during the past year, on the plea that distance or other engagements prevented their attendance at the Society's meetings. The absence of these gentlemen from the meetings is regrettable, but it is much more to be deplored that the absence of their subscriptions will materially curtail the usefulness of the Society in recording scientific facts. This action is also the more unfortunate at the present time, when the Association for the Advancement of Science has been started, as Fellowship of one of the learned Societies meant *ex officio* membership of the Association on the payment of the subscription.

Your Council has also with much regret to report the loss by resignation of one of your Vice-Presidents, Mr. R. L. Mestayer, C.E., F.R.M.S., his professional duties having caused him to leave the Province. Your Council finds that not only has the Society suffered a loss by his unavoidable departure, but that the management of the affairs of the Society has experienced a deprivation in losing his uniformly sound and intelligent advice.

The reports of the two Sections of the Society, namely, the Field Naturalist and Microscopical Sections, show that they continue to thrive and to do excellent work preparatory to undertaking more arduous scientific labours, and are thus enabling

Digitized by Google

their members how to become ultimately working Fellows and leaders in the parent Society.

During the past year the library has been enriched by numerous additional works and the proceedings of the various scientific Societies. Amongst other books may be mentioned the "Iconography of Australian Species of Acacia and Cognate Genera" (eight decades), by Baron v. Mueller; "Descriptive Catalogue of the Medusæ of Australian Seas," by B. von Lendenfeld; "Bulletin of the Museum of Comparative Zoology, Harvard College;" "Fourth Annual Report of the Bureau of Ethnology, Smithsonian Institute;" "The U.S. Geological Surveys, Monographs;" and the "Eucalypts of Australia," by Baron v. Mueller.

The Council has continued to authorise the execution of more plates to illustrate the second part of Prof. Tate's paper on the "Gastropods of the Older Tertiary of Australia." It is a matter for congratulation that Prof. Tate's labours have enabled the Council to expend the money in so advantageous a manner.

Your Council also thinks that it is matter for great satisfaction that one of our Fellows (Dr. Whittell) was able from his position as President of the Central Board of Health, to completely disprove the opinion advanced by Dr. Jamieson, of Melbourne, viz., that the deep-drainage of the City of Adelaide was not the success it was thought to be as a factor in diminishing the mortality rate. Not only is the matter an important one to the City of Adelaide itself, but also as helping to strengthen the hands of the Executive in places not yet provided with the same admirable system.

The Council has deemed it advisable to cause certain volumes of the Society's "Proceedings" (Nos. 1, 5, 6) to be withdrawn from sale on account of the limited number of copies on hand. In future these volumes will not be parted with, unless the special permission of the Council has been obtained. A uniform price has also been fixed for the other annual volumes, which can always be obtained from the Secretary.

The Council cannot refrain from alluding to the fact that the first meeting of the Australian Association of Science, lately held in Sydney, has now become a matter of history. It is also gratifying to note that the various Fellows of this Society took a prominent part in the inaugural proceedings, Prof. Rennie being a Vice-President, Prof. Tate the President of the Biological Section, and Prof. Bragg holding the important position of representative delegate on the Council.

The Society will be pleased to note from the Hon. Treasurer's statement that the receipts this year have been larger than for any previous one.

Digitized by Google

PRESIDENT'S ADDRESS.

PROFESSOR RENNIE read his annual Presidential address as follows:—

It is with feelings of some regret that I am here this evening to deliver the annual address as President of the Royal Society of South Australia; regret, I mean, that I have not been able to do so much as I would like to have done to promote its interests. My failure to do more has arisen partly from the multiplicity of other duties to which I have been obliged to give attention during the past two years, and partly from the fact that the subjects dealt with by the Fellows who have come before us here have been for the most part connected with a department of science with which I am far from familiar, viz., Natural History. This must always be more or less a principal subject with a young Society in a new country. It is therefore with great satisfaction, I think, that we should welcome as two new members of council for the ensuing year two gentlemen who are zealous students of the natural sciences, and to one of whom the Society owes a great deal of what success has attended its meetings, if not its actual existence, in past years.

Turning now to those matters on which I am to address you this evening, let me say first that I had considerable difficulty in the choice of a subject, scarcely knowing what would prove most interesting to this audience. It has very appropriately been the custom on similar occasions to give some account of the advances made during the past year or years in the subject with which the speaker is most familiar, but in this case such a course would have necessitated such an account of the more abstruse portions of chemistry as could scarcely have been condensed into the limits of such an address as this, even if they proved of sufficient interest to the majority of my hearers.

After some deliberation I have decided to say a few words on the present state of some of those industries of these colonies in which chemical science is more or less involved, and in some cases to suggest what seem to me to be the possibilities of economy and development in the future. I do not claim originality, nor do I claim to be in a position to discuss fully all the circumstances of each case, but simply venture to hope that by drawing attention to certain facts some few may be induced to think over the possibilities of future improvement, and, perchance, to take steps to bring about practical advances in our industrial processes. If some of

Digitized by Google

the suggestions should be proved to be impracticable owing to local circumstances, at least no harm can be done by having them under discussion.

AGRICULTURAL AND PASTORAL.

What is the condition of affairs in this colony? Is the yield of wheat anything like what it used to be? On all sides we hear statements of the great differences between the yields of earlier and later years. It goes without saying that a great deal depends upon the rainfall. Nothing can be done without water, and it is a matter of satisfaction that the settlers in the colonies are gradually becoming alive to the absolute necessity for better water conservation. But given fair average seasons, how is the falling-off in the crops to be accounted for? The obvious answer is—Exhaustion of the soil. But what are its causes, and are there any remedies? Every year sees the export from this colony of thousands of tons of wheat, to say nothing of other cereals. Now every ton of wheat contains on an average about 18 lb. of phosphorus oxide and 7 lb. of potash. Both of these substances in certain forms of combination are essential elements in a fertile soil; but they are only present in very small quantities even in the best land. Besides this a not inconsiderable quantity of potash is carried off with all the unwashed wool that leaves our shores. If this is to go on without some compensation the yield of cereals, grasses, &c., must inevitably become smaller and smaller, and the crops will be rendered more liable to be attacked by parasitic diseases. Deeper ploughing will do something for a time, but only for a time; something more is necessary. In many cases, I fear in most cases, nothing is being done to make up for the loss. Nothing in fact can be done, except by the addition of natural or artificial manures and systematic farming. This, of course involves careful preservation of all materials which can in any way be applied to manurial purposes. In this last respect there is great want of care. If anything successful is to be done with working men's blocks and such comparatively small tracts of land as are likely to be benefited by the Beetaloo and such like irrigation schemes, careful cultivation is absolutely necessary, for water alone will not supply all that is needful for the growth of crops. What are the facts in most cases? Little or no care is taken to utilise farmyard manure to the best advantage, yet this is a form of manure eminently adapted for most purposes, containing as it does nitrogen compounds and phosphates in a form especially suitable for assimilation by plants. Wood ashes, which contain a considerable proportion of potash salts, and of which a not inconsiderable quantity is produced every year in every farm-house, are thrown out anywhere and everywhere. The same is true of bones. With a little extra trouble they could be all burnt,

Digitized by Google

adding thereby very materially to the value of the ashes; or, better still, by a cheap mill they could be ground to bonedust and so give nitrogen as well as phosphates to the soil. The quantities of phosphates, nitrogen, and potash salts obtainable from the above sources would not be suffieient to replace the loss on a large farm, but they would do something towards it, and would certainly be of considerable use in increasing the produce of the orchard or vegetable garden. Quantities of bones, bonedust, and superphosphate are being from time to time exported from the colony. Surely this is a needless sending away of valuable manure. It seems to me there must be something very seriously wrong somewhere when such valuable materials can be exported from such a colony as this at a profit. Then, again, there is sulphate of ammonia, a most valuable manure in some cases. There is so little sale for this, now that the Mauritius market has failed, that the Gas Company are hesitating whether to continue the manufacture. Yet it is obtainable at a reasonable price, and not a pound of it should be allowed to leave the colony. There is strong evidence of want of thrift and economy among a large proportion of our rural population. The days are gone in which crops could be obtained by merely scratching the surface of the soil. Every day it is becoming more manifest that careful and economical treatment is necessary to make the land yield any kind of produce continuously. The much persecuted Chinaman is certainly a pattern in this respect. He has come from a country where the very existence of the population depends to a large extent upon the proper treatment of the land, and he has learnt the lesson well. He takes good care that nothing is wasted, and he obtains results accordingly. Possibly something may be done by training the children in our schools, country schools in agricultural districts especially, in such a way as to make them practically acquainted with such matters, and by endeavouring to foster in them a liking for agricultural pursuits. Is it not desirable that experiments should be undertaken with a view of discovering what are the best methods of farming in this colony under varying conditions? In England, in various parts of Europe, and in America there are large experimental farms, established either by the Government or by private enterprise, in which such experiments can be carried out on scientific principles. The results obtained by years of painstaking investigation at the experimental station carried on by Messrs. Lawes & Gilbert at Rothamstead have proved invaluable all over the world. Associated with these stations in many cases are well-equipped Agricultural Colleges. What have we here? An Agricultural College, it is true, but very insufficiently equipped internally as regards the appliances for proper scientific teaching, of even an

Digitized by Google

elementary character, to say nothing of investigation, and externally with one of the worst pieces of land in the whole district, and besides all that with an endowment utterly inadequate for effectively carrying out experiments such as have been alluded to. Reference has already been made to the fact that potash salts are carried off with all the unwashed wool that leaves our ports; but apart from this no effort is made, so far as I know, to preserve for manurial purposes the potash salts which find their way into the water in which wool is washed. Professor Tate drew attention to this matter some ten years ago in some science notes communicated to the *Register*. The greasy matter of wool is composed of certain peculiar fatty substances, some fatty acids, and potash salts in the form of soaps. These latter find their way into the wash-water, and here are simply wasted; but in Europe the water is evaporated, the residue calcined in gas retorts, yielding by that treatment considerable quantities of ammonia and illuminating gas, and the charred product washed to extract the potash salts, which are obtained in a form readily convertible into valuable manure. A process has recently been patented in this colony, of which a trial took place some time ago, for extracting the potash salts from wool by water, and the greasy matter by carbon disulphide. The patentees have proceeded to England with a view of perfecting certain parts of the apparatus, which cannot be obtained here. The use of carbon disulphide for extracting greasy matters is not new, but has been tried more than once and abandoned owing to various difficulties connected with its use. Possibly, however, the new process involves improvements which will render the process workable and profitable. The value of the greasy extract depends mainly on one of its constituents, a substance known as cholesterin, which is found in human gall-stones, in feathers, hair, whalebone, &c., and which possesses the peculiar property not possessed by ordinary fats of absorbing more than 100 per cent. of water. Mixed with a certain proportion of water it is known as lanolin, and this substance is stated to be much more valuable for making plasters, ointments, &c., than vaseline, paraffin, or lard, being much more readily absorbed by the skin, carrying with it the various medicaments with which it may be mixed, Again, potash salts are sometimes carried off in some quantity in the "argol" or "tartar" which separates from grape juice during fermentation. This substance is known chemically as potassium bitartrate, and is in many cases sold to chemists for the manufacture of cream of tartar, and for other purposes. It is not impossible, however, nay, it is highly probable, that a continual draining off of this compound from the soils of our vineyards without corresponding replacement may produce damaging effects.

Digitized by Google

hereafter. We may safely take it for granted that the invariable presence of considerable quantities of the substance in the fruit has some intimate connection with the healthy growth of the vine.

FOREST CONSERVATION.

In the matter of forest conservation we are well off in this colony, and our energetic Conservator of Forests has achieved great success in this direction. You will have noticed that he is proposing to supply a large quantity of charcoal for use at Broken Hill. This means a large waste of by-products if it is to be made by the old method of burning. Mr. Brown informs me, however, that he is thinking of introducing the system of carbonizing in retorts, and so preserving the liquid products, which are of considerable value, containing as they do creosote, pyroligneous acid, and wood spirit. For all of these there is some demand. There is great need of a supply of the latter article of good quality for methylating purposes, the material imported for that purpose being wretched stuff, containing a considerable quantity of hydrocarbons, which are immediately precipitated on dilution with water. The Conservator also contemplates the production of turpentine from the pine forests, which are growing successfully in some of the northern parts of the interior. I am sure you will welcome these advances in utilization of our own products.

PRODUCTION OF TANNIN.

Another subject connected with one of the products of the colony is the production of tannin from the bark of the various species of acacia. This scarcely seems to be attracting the attention it deserves. A great deal remains to be done in the direction of ascertaining the best varieties of wattles which will flourish under different conditions, and above all of ascertaining at what stage of growth it is most advantageous to strip the tree, or cut it up into fragments, as is now done at Messrs. Barrow & Haycraft's establishment at Echunga. There has, however, been needless waste in the ruthless destruction of young trees which would have yielded much more tannin had they been allowed to grow for a year or two longer. If the demand increases, as it is certain to do (unless indeed some cheap substitute for tannin be found), there will probably be a difficulty in supplying the demand. Putting in a few wattle seeds now and again on spare land does not involve a large amount of time or labour, and many a landholder might add to his income in the future by a judicious and systematic planting of this useful tree. Some very valuable investigations on Australian tannin-yielding trees, and the percentage of tannin they contain, have been recently published by Mr. G. H. Maiden, Curator of the Technological Museum in

Digitized by Google

Sydney, in the Proceedings of the Royal Society of New South Wales. Mr. Maiden is still pursuing his energetic labours in this direction, and further results will, I understand, soon be published.

OIL-YIELDING PLANTS.

The cultivation of certain oil-yielding plants may yet yield good results. Olive oil has for some years been successfully produced in South Australia. It is a splendid article, and is deservedly commanding an increased sale. There is, I am told, some prospect of a trial being made with castor oil. For this oil there is a considerable demand, and, judging from the facility with which the tree grows, there seems no reason why it should not be successfully cultivated. There were some good specimens of sesame and peanut oil from the Northern Territory shown at the Exhibition last year. From this I gather that the plants yielding those oils grow well in that district. Then again there are doubtless many indigenous trees capable of yielding valuable products, medical or otherwise, but the investigation of such matters requires long and patient labour, and there are few workers in the field.

METALLURGY.

So long as metallurgical processes are conducted on a small scale, as they are at present, little can be done that has not already been done in the matter of economy. In older countries large metallurgical works, such as those at Freiberg, include a large number of different processes, yielding different products, and all help to contribute to their success. Here the great difficulty seems to be to obtain a market for many of the products. For example, in connection with the extraction of gold from pyrites, the latter can be burned in suitably constructed kilns, and the sulphur dioxide so produced utilised in the manufacture of sulphuric acid, the residue being in a condition suitable for extraction of gold by amalgamation. But most samples of pyrites contain arsenic, which can only be partially condensed, though it often is condensed in Europe and preserved for various purposes. The sulphuric acid from the pyrites therefore becomes contaminated with arsenic, and would not command such a ready sale for some purposes as the purer article, though it might be applied in many cases just as well as the purer acid. The great difficulty is that more acid would be produced than there is a market for. But may it not be possible in some instances to combine with the manufacture of sulphuric acid from this source other processes in which the sulphuric acid could be utilised? At Mount Morgan I am credibly informed that it is intended to make the sulphuric acid and chloride of lime used in the Newberry-Vautin chlorination process. If this be the case I am not

Digitized by Google

without hopes that something may yet be done in a similar direction with ores far less rich than those of Mount Morgan. In cases where the pyrites contain small percentages of copper it is possible sometimes to extract this economically by the wet process by the aid of sulphuric acid. There are many other possible ways in which the acid might be utilised, but the success of any one of them would depend largely on local circumstances. We have heard something lately of so-called paint mines. By these are meant of course deposits of coloured oxides of iron which can be manufactured into paints. At Ballarat the residues after roasting iron pyrites and extraction of the gold are now being utilised for this purpose, the oxide of iron being in a very fine state of division and of sufficiently good colour to command a sale. Reference has been made to the preparation of chlorine for the extraction of gold. In the chlorination process chloride of lime is used as the source of chlorine. Now this substance in solution is generally regarded as a mixture of calcium chloride and hypochlorite, but whatever view be held as to its nature, less than half its weight is chlorine available for the purpose of gold extraction. Is it not somewhat anomalous that the chlorine should first have to be prepared in Europe, then converted into chloride of lime, of which remember less than half the weight is chlorine, then imported to Australia, with very often a considerable loss of chlorine before it is actually used. It will perhaps be said that all this is compensated for by convenience in working and saving of time and labour where this substance is used, the direct use of chlorine involving extra plant, and perhaps more wear and tear. Be this as it may, there still seems to me to be matter for reflection for those concerned. A suggestion has been made to use bromine water instead of chlorine gas, the bromine being of course all recovered and used again. The obstacle here would be the shipping difficulty, bromine being a dangerous substance to deal with if a breakage should occur. In appliances for gold-saving by amalgamation the necessity for bringing the mercury into intimate contact with the finely divided gold is becoming more and more apparent. Attempts have been made with more or less success to effect this by means of grinding machinery, but lately a process has been patented which presents some new features. The roasted auriferous ore in a fine state of division is brought by means of a powerful blast in contact with the vapour of boiling mercury. It is claimed that by this means a very perfect amalgamation takes place, the mercury condensing and taking the gold down with it. It is claimed that the process can be made continuous by using the same mercury over again. It is an ingenious idea, but one of the difficulties, it seems to me, will be the loss of mercury by oxidation, caused by contact of the

Digitized by Google

oxygen of the air with the hot vapour of the metal, it being a well-known fact that mercury in contact with oxygen at a high temperature becomes oxidized. In silver smelting greatly improved results are now obtained as compared with those of a few years ago, doubtless owing to the employment of skilled metallurgists, but that there is a considerable loss of lead is evidenced by the fact (if evidence were wanting) that a large number of persons at Broken Hill show some of the minor symptoms of lead-poisoning. In Europe great efforts are made to condense lead fumes as completely as possible, so as to recover the metal. Probably enough it would not pay to erect condensing flues for this purpose at such places as Broken Hill, but the fact remains that there is waste, and such waste as might make a considerable difference in large works employed in smelting poorer ores, and may we not hope to see metallurgical processes so carried out in Australia in the future as to render possible the profitable treatment of such poorer ores.

CHEAP SALT.

Closely connected with the possibility of preparing chlorine by a paying process is the production of cheap salt. Surely there should be little difficulty about that. For this purpose the salt need not be purified at all, but the residue from sea water or salt lakes used just as it is, and in the hot dry parts of this colony near the seacoast large quantities of sea water could be evaporated at a very small outlay. Moreover, I cannot see why good salt for table and other domestic purposes should not be manufactured in quantity as it is on the shores of the Mediterranean by the aid of the sun's heat alone. If there is a prejudice against colonial articles there must be some cause for it. Probably the sending into the market of carelessly manufactured and imperfectly purified products has had a good deal to do with it; and in this particular instance the evaporation of sea water needs to be carefully carried out to produce a good marketable article, while that salt obtained from salt lakes, the result of inland drainage, is sure to contain considerable quantities of magnesium compounds, which will render it bitter and unsuitable for domestic use, unless means are taken to remove these objectionable substances. If our colonial manufacturers are to succeed it is absolutely necessary that good articles should be produced.

ECONOMY IN THF USE OF GAS.

In recent years a great deal has been done in the direction of economizing fuel in large works requiring the use of powerful furnaces. It is well known that the gases which escape from ordinary closed furnaces are not completely burnt. The complete combustion of these gases is now effected by introducing under certain conditions a secondary supply of air, this air being

Digitized by Google

itself heated by the final escape gases from the furnaces. This secondary combustion gives a very high temperature, and is the means of an enormous saving of fuel. The combustible gases may also be increased in quantity by causing a small quantity of steam to pass through the primary furnace, and the necessary quantity of steam can be obtained by means of the heat from the spent gases. This principle has been successfully applied by the manager of the gasworks at Bowden, a bed of retorts being heated entirely by the secondary combustion of the half-burnt gases from one of the ordinary furnaces. It is obvious that the principle is capable of very extensive application. A somewhat similar principle applies to economy in the use of gas for illuminating purposes. The contrivances for this purpose are so arranged that the gas is heated to a high temperature before it reaches the mouth of the burner by means of the heated gases resulting from its own combustion. It is well known that under these conditions a very much better light is obtainable with the same consumption of gas. There are various types of burner constructed on this principle, but they are not easily adaptable to the rooms of an ordinary dwelling-house. They are, however, well suited for lighting large spaces. They were in use in Holborn before I left London, some five or six years ago, and I notice that one form has been introduced into some few of the shops in Adelaide. In this connection it may not be out of place to mention the greatly improved simple burners (Sugg's for example), which are easily obtainable at a moderate price, and can be easily fitted in place of the wretchedly dim older-fashioned burners. A great deal better light can be obtained by their means with a smaller consumption of gas.

CONCLUSION.

Fortunately, or unfortunately, we have not yet in these colonies reached that stage of our history in which rigid economy in industrial and manufacturing processes and utilization of all waste products becomes a necessity. It is a matter of history in Europe that in some instances what were originally regarded as waste products have become, if not the principal objects of manufacture, at least those upon which the success of the undertaking, from a commercial point of view, depends. At some future time this may be the case here; at any rate, it is always useful to keep in mind the fact that materials, valuable in themselves, are neglected, because it is always possible that the knowledge that such is the case may stimulate to discoveries of new processes for their utilization."

On the motion of Professor TATE, seconded Mr. TODD, Professor Rennie was thanked for his address, which was referred to in terms of the highest praise.

Digitized by Google

Mr. TODD said it would be of great value to the country.

Mr. T. PARKER, C.E., referred to the assertion that the water in some of the rivers was said to be unfit for irrigation owing to the presence of saline matter. He had known land to thrive after this water had been on it, and he wondered whether the saline matter had not manuring properties. The Society might properly investigate the question.

Professor RENNIE said that in certain cases it was difficult to say positively that water was unfit for irrigation unless an actual trial proved it to be so.

Mr. TODD mentioned that around the mountain springs at Hergott and Strangways the country was very destitute. On the other hand, the country around the artesian bore at Strangways was in better condition.

Mr. TEPPER said the use of saline water was more successful on sloping ground, where the saline matter would not remain.

The following papers were presented :—By the Rev. T. Blackburn, "On Australian Coleoptera, with descriptions and new species;" by Prosessor R. Tate, F.G.S., "Gastropods of the Older Tertiary of Australia, Part II.," "Additions to the Lamellibranchiata of South Australia," "Additions to the Flora of Port Lincoln," "Plants of the Lake Eyre Basin," "Definitions of New Species of Plants," "A Census of the Molluscan Fauna of Australia," "Description of new Genera and Species of Australian Mollusca;" and by Mr. W. Howchin, F.G.S., "On the Occurence of Coal Drift on the Murray Flats."

Digitized by Google

THE TREASURER IN ACCOUNT WITH THE ROYAL SOCIETY OF SOUTH AUSTRALIA.

Dr.	£ s. d.	£ s. d.
October 1st, 1887.		
To Balance brought forward ..		260 14 11
" Subscriptions—Royal Society ..	106 11 6	
Field Naturalists' Section	20 0 0	
Microscopical Section ..	14 6 6	
		140 18 0
" Government Grant		66 13 0
" Interest		9 6 0
" Sale of Transactions		3 13 6
		£481 5 5

Cr.	£ s. d.	£ s. d.
By Cost of Transactions—		
Printing and Binding ..	117 12 10	
Illustrating (£31 10s. included in last year's accounts) ..	3 3 0	
Editing and Publishing ..	4 15 1	
		125 10 11
" Salaries, &c.—		
Assistant Secretary	21 0 0	
Attendant	1 7 0	
Collector	3 11 6	
		25 18 6
" Advertising		5 9 1
" Printing, postage, stamp tax, and stationery		11 4 4
" Field Naturalists' Section—Grant ..	25 0 0	
Printing Prize List	1 0 0	
		26 0 0
" Microscopical Section—Grant ..		18 0 0
" Library—Binding	5 19 0	
Cupboard	6 5 0	
		12 4 0
" Balance—Bank of South Australia ..	60 14 8	
Savings Bank	196 3 6	
Cash in Treasurer's hands ..	0 0 5	
		256 18 7
		£481 5 5

Audited and found correct.
W. B. POOLE, Auditor.
September 30, 1888.

WALTER RUTT, Treasurer.

Digitized by Google

DONATIONS TO THE LIBRARY

For the Year 1887-8.

I.—Transactions, Journals, and Reports.

Presented by the respective Societies, Editors, and Governments.

Batavia—Naturrkundig-Tijdschrift voor Netherlands-Indie; Proceedings, Deel XLVII.; Achtste Serie, Deel VIII.

Baltimore—American Chemical Journal; vol. VIII., Nos, 4, 5, 6; vol. IX., Nos. 1, 2.

——— Johns Hopkins' University Studies in Historical and Political Science; fourth series, Nos. 7 to 12; fifth series, Nos. 1 to 7.

——— Eleventh Annual Report of the Johns Hopkins' University, 1886.

——— Johns Hopkins' University Circulars; Nos. 50 to 57.

——— Johns Hopkins' University Register, 1886-7.

Belfast (Ireland)—Report and Proceedings of the Belfast Natural History and Philosophical Society for 1886-7, Nos. 20 to 25 (1887).

Koniglich Preussischen Meteorologischen Institut—Ergebnisse Beobachtungen, in Jahre, 1886.

Belgium—Société Royale Malacologique de Belgique-Procès-Verbal de Assemblée Generale Annuelle, pp. LXXXI. to CXLI.

Berlin—Sitzungberichte der Koniglich Preussischen Akademie der Wissenschaften zu Berlin; Nos. 19 to 44, 1887, title, index, &c., 1888, Nos. 1 to 20.

Boston—Proceedings of the American Academy of Arts and Sciences; new series, vol. XIV. (whole series, vol. XXII.), part 1.

Brisbane—A Sketch of the Economic Plants of Queensland; by F. M. Bailey, F.L.S.

——— Catalogue of Woods in the Queensland Court, Centennial International Exhibition, Melbourne.

——— Catalogue of the Grasses in the Queensland Court, C.I.E., Melbourne.

Digitized by Google

Brisbane—Classified Index to the Indigenous and Naturalised Plants of Queensland; by F. M. Bailey, F.L.S.
——— A Synopsis of the Queensland Flora, second supplement; by F. M. Bailey, F.L.S.
——— Proceedings of the Royal Society of Queensland; vols. I., II., III.; vol. V., part 1.
Buenos Ayres—Boletin de la Academia Nacional de Ciencias en Cordoba (Republica Argentina); tomo X.; Entrega, 1a et 2a.
California—Bulletin of the California Academy of Sciences; vol. II., Nos. 6, 7.
——— Californian State Mining Bureau. Seventh Annual Report of the Mineralogist for year ending October 1, 1887.
Cambridge—Bulletins of the Museum of Comparative Zoology at Harvard College; vol. XIII., Nos. 5 to 10; vol. XVI., No. 1; XVII., No. 1.
——— Sixth Annual Report of the Curator of the Museum of Comparative Zoology at Harvard College, 1886-7.
Canada—Geological and Natural History Survey of Canada. Catalogue of Canadian Plants; No. 3, Apetalæ.
——— Summary Report of the Operations of the Geological and Natural History Survey of Canada, to December, 1887.
——— The Canadian Record of Science; vol. III., Nos. 2. and 3.
——— Geological and Natural History of Canada, Annual Report; new series, vol. II., 1886.
Christiania (Norway)—Tordenvejerenes Hyppighed i Norge, 1867-1883; af H. Mohn.
——— Die silurischen Etagen 2 und 3 im Kristianiagebit und auf Eker; von W. C. Brogger.
——— Silurfossiler og Pressede Konglomerater i Bergenskifrene; af Hans H. Reusch.
——— Jahrbuch des Norwegischen Meteorologischen Instituts fur 1876; als. 1887.
——— Die Internationale Polarforchung, 1882-83; Beobachtungs-Ergebnisse der Norwegischen Polarstation Bossekop in Alten.
Dublin—The Scientific Proceedings of the Royal Dublin Society; vol. V. (N.S.), parts 7, 8; vol. VI. (N.S.), parts 1, 2.

Digitized by Google

Göttingen—Nachrichten von der Koniglich Gesselchaft der Wissenchaften und der Georg-Augusts Universität zu Göttingen; aus dem Jahre, 1886; Nos. 1-20.

Japan—Journal of the College of Science, Imperial University, Japan; vol. I., part 4; vol. II., part 1.

——— Transactions of the Seismological Society of Japan; vol. II. (1887), parts 1, 2, 3; vol. XII.

Lausanne—Bulletin de la Société Vaudoise des Sciences Naturalles; series 3, Nos. 96, 97.

London—Journal of the Royal Microscopical Society, 1887; parts 6, 6a, 1888; parts 1, 2.

——— Royal Colonial Institute—Report of the Council, Feb. 21, 1888.

——— Transactions of the Entomological Society for 1887.

Massachussetts—Bulletin of the Essex Institute; vol. 18, Nos. 1 to 12.

Manchester—Report and Proceedings of the Manchester Field Naturalists' and Archæologists' Society for 1887.

——— Proceedings of the Manchester Literary and Philosophical Society; vols. XXV. and XXVI.

——— Memoirs of the Manchester Literary and Philosophical Society; vol. X. (new series).

Mexico—Annario del Observatorio Astronomico Nacional de Tacubaya para et 1888; vol. VII. By Angel Anguiasso.

München—Sitzungberichte der Mathematisch - Physicalischen Classe der k.b., Akademie der Wissenschaften zu München; heft I., 1886; heft II., heft III.

——— Gedachtnisrede auf Joseph von Fraunhofer.

——— Abhandlungen der Mathematisch - Physicalischen Classe der Koniglich-Bayerischen Akademie der Wissenschaften, 1887; vol. XVI., part 1.

——— Do., do., Sechzenten Bandes, zweite Abtheilung.

New Jersey—Journal of the Trenton Natural History Society; No. 2 (1887).

New South Wales—Journal and Proceedings of the Royal Society of New South Wales; vol. XX., 1886; vol. XXI., part 3; vol. XXII., part 1.

——— Annual Report of the Department of Mines, New South Wales; 1886.

——— Geology of the Vegetable Creek Tin Mining Field, New England District. By T. W. Edgworth David, B.A., F.G.S.

Digitized by Google

New South Wales—Proceedings of the Linnean Society of New South Wales; second series; vol. II., parts 3 and 4; vol. III., parts 1, 2.

——— List of Contributors to the First Series; vols. I. to IX. of the Proceedings of the Linnean Society of New South Wales.

——— Descriptive Catalogue of the Medusæ of the Australian Seas. R. von Lendenfeld, Ph.D.

——— Australian Museum—History and Description of the Skeleton of a new Sperm Whale (Euphysetes). Reprint from 1851 edition.

——— Australian Museum—Hints for Collectors of Geological and Mineralogical Specimens. By F. Ratte.

——— Notes for Collectors. F. Ratte.

——— Descriptive Catalogue of the General Collection of Minerals. Felix Ratte.

——— Catalogue of the Echinodermata in the Australian Museum; part 1—Echini. Dr. E. P. Ramsay, F.R.S.E.

——— Catalogue of the Collection of Fossils in the Australian Museum. Dr. E. P. Ramsay.

——— Hints for the Preservation of Specimens of Natural History. E. P. Ramsay, F.R.S.E., &c.

——— Catalogue of the Australian Birds in the Australian Museum; part 1—Accipitres. E. P. Ramsay, F.L.S., C.M.Z.E., &c.

——— Catalogue of the Australian Hydroid Zoophites. W. M. Bale.

——— Calendar of the University of Sydney.

——— Supplement to the Australian Museum Report—Technological, Industrial, and Sanitary Museum. Report for 1887.

——— Australasian Association for the Advancement of Science—Programme, &c., for first meeting on October 28, 1888; ten copies.

——— Catalogue of the Fishes in the Collection of the Australian Museum; part 1—Recent Palæichthyan Fishes. By J. Douglas Ogilby, F.L.S.

Digitized by Google

New South Wales—Australian Museum—Report of the Trustees for 1887.

———— Australasian Association for the Advancement of Science—Papers, Clippings, &c., connected with the First Annual Meeting in Sydney; 1888.

New York—Transactions of the New York Academy of Sciences; 1885-86.

———— Annals of the New York Academy of Sciences; vol. III., Nos. 11 and 12; vol. IV., Nos. 1, 2.

———— Raising Diatoms in the Laboratory. By Prof. Samuel Lockwood, Ph.Dr.

New Zealand—Index to Reports of the Geological Survey of New Zealand, 1866 to 1885.

———— Twenty-second Annual Report on the Colonial Museum Laboratory.

———— Studies in Biology for New Zealand Students; No. 3.

———— Reports of Geological Explorations during 1885 and 1886-87.

———— Report of the Auckland Institute, 1887.

———— Report on the Eruption of Tarawera and Rotomahana. By A. W. P. Thomas, M.A., F.L.S., &c.

Norway—Bergens Museums Aarsberetning for 1886.

Philadelphia—Journal of Comparative Medicine; vol. VII.

———— Proceedings of the Academy of Sciences of Philadelphia, 1887; part 1, 2, 3.

Queensland—Account of the Operations of the Weather Bureau, and List of Stations. By Clement L. Wragge.

———— Proceedings of the Royal Society of Queensland (1880); vol. V., part 2.

South Australia—Report of the Board of Governors of the Public Library, Museum, and Art Gallery of South Australia.

———— Transactions of the Intercolonial Medical Con-Congress of Australasia. First Session (Sept., 1887).

———— Our Waste Lands and our Productions. By S. Newland.

———— Rainfall in South Australia and Northern Territory, with Weather Characteristics of each month. Dec., 1887, Jan., Feb., March, 1888.

St. Louis—Transactions of the Academy of Science of St. Louis; vol. IV., No. 4, 1878-86.

Digitized by Google

Tasmania—Papers ordered by the Legislature to be printed.
———— Transactions and Proceedings of the Royal Society of Tasmania, 1877 to 1887,

Turin—Bulletino dei Musei di Zoologia ed Anatomia Comparata della R. Universita di Torino. Nos. 27 to 35, 39 to 48.

Valdivia—Verhandlungen des deutschen Wissenschaftlichen Vereins zu Santiago.

Victoria—The Victorian Naturalist; vol. IV., Nos. 7 to 12; vol. V., Nos. 1 to 6.

By the Victorian Government:—

———— Iconography of Australian Species of Acacia and Cognate Genera. By F. von Mueller. Decades 1 to 12.
———— Podromus of the Zoology of Victoria. By Fredk. McCoy. Decades 1 to 16.
———— Victorian Year-Book for 1886-7.
———— Eucalyptographia (Eucalypts of Australia). Ninth Decade. F. von Mueller.
———— Victorian Engineer; vol. III., No. 3.
———— Transactions and Proceedings of the Royal Society of Victoria; vol. XXIV., part 2.
———— Transactions of the Geological Society of Australasia; vol. I., part 3.

Vienna—Kaiserlich Akademie der Wissenschaften in Wien. Jahrg, 1887. Sitzung der Mathematisch-naturwissenschaftlichen Classe; Nos. 20 to 28, and index; Jahr, 1888; Nos. 1 to 12, 14 to 19.
——— Verhandlungen der K. K. Geologischen Reichenstalt, 1886, Nos. 5, and 13 to 18; 1887, Nos. 1, 6, 17, 18; 1888, Nos. 1, 2, 3, 4, 7, 8, 10, 11.
——— Verhandlungen der K. K. Zoologisch-botanischen Gesellschaft in Wien; vol. XXXVI., parts 3, 4, 9.

Warsaw—Langue Internationale. Preface et Manuel complet. By Dr. Esperanto.

Washington—Circulars of Information of the Bureau of Education, No. 1; 1887, No. 2.
———— Scientific Writings of Joseph Henry; vols. I., II.
———— Fourth Annual Report of the Bureau of Ethnology to the Secretary of the Smithsonian Institution, 1882-3.
———— United States Geological Surveys.—Monographs; vol. X., Dinocerta; vol. XI., Lake Lahontan.
———— Memoirs of the National Academy of Sciences; vol III., part 2.

Digitized by Google

Washington—Bulletins of the United States Geological Survey; Nos. 30 to 39, and index.
———— Mineral Resources of the United States, year 1885.
———— Annual Report of the Board of Regents of the Smithsonian Institution to July, 1885, part 1.
———— Sixth Annual Report of the United States Geological Survey, 1884-5.
———— Classified List of Publications of the Smithsonian Institution.
Würzburg— Sitzungsberichte der Physicalisch - Medicinischen Gesellschaft zu Würzburg, 1887.

Digitized by Google

LIST OF FELLOWS, MEMBERS, &c.

NOVEMBER, 1888.

Those marked (F) were present at the first meeting when the Society was founded. Those marked (L) are Life Fellows. Those marked with an asterisk have contributed papers.

		Date of Election.
HONORARY FELLOWS		
Barkley, Sir Henry, K.C.M.G., K.C.B.	... ...	1857
Ellery, R. L. J., F.R.S.	Melbourne	1876
*Garran, A., L.L.D.	Sydney	1853
*Hull, H. M.	Hobart	1855
Jervois, Sir W. F. D., K.C.M.G., C.B.	New Zealand	1878
Little, E.	... ...	1855
Macleay, Hon. W., F.L.S. ...	Sydney	1878
*Mueller, Baron F. von, K.C.M.G., F.R.S.	Melbourne	1879
*Russell, H. C., B.A., F.R.A.S. ...	Sydney	1876
Warburton, Col. P. E., C.M.G. ...	Beaumont	1858
*Woods, Rev. J. E. T., F.L.S., F.G.S.	Sydney	1877
CORRESPONDING MEMBERS.		
Bailey, F. M, F.L.S.	Brisbane	1881
Canham, J.	Stuart's Creek	1880
*Cloud, T. C., F.C.S.	Wallaroo...	1881
*Dennant, J., F.G.S.	Castelmaine	1888
*East, J. J.	Prospect	1884
*Foelsche, Paul	Palmerston	1882
Goldstein, J. R. Y.	Melbourne	1880
*Hayter, H. H., M.A., C.M.G., F.S.S.	Melbourne	1878
Holtze, Maurice	Palmerston	1882
*Kempe, Rev. J.	Finke	1880
*Maskell, W. M.	New Zealand	1888
Nicolay, Rev. C. G.	Fremantle, W.A.	1886
*Richards, Mrs. A.	Beltana	1880
*Stirling, James, F.L.S.	Omeo	1883
FELLOWS.		
*Adamson, D. B.	Adelaide	1867
Adcock, D. J.	Adelaide	1887
Angas, J. H.	Angaston	1874
Angove, W. T., M.R.C.S.... ...	Tea Tree Gully	1888
Bagot John	Adelaide	1887
*Blackburn, Rev. Thos., M.A. ...	Woodville	1887
Boettger, Otto	Adelaide	1884
Bragg, Prof.	Adelaide	1886
Brown, J. E., F.L.S.	Adelaide	1882

Digitized by Google

Brown, L. G.	Two Wells	1882
Brown, H. Y. L., F.G.S.	Adelaide	1883
Bussell, J. W.	Adelaide	1884
*Campbell, Hon. Allan, M.L.C., L.R.C.P., Edin.	Adelaide	1882
Chapman, R. W., B.Sc.	Adelaide	1888
*Cleland, W.L., M.B., Ch.M., F.R.M.S.	Parkside	1879
*(L)Cooke, E.	Adelaide	1876
*Cooke, W. Ernest, B.A., ...	Adelaide	1885
Cox, W. C.	Semaphore	1880
*Crawford, F. S.	Adelaide	1865
*Davenport, Sir Samuel	Adelaide	1856
Davies, Edward	Adelaide	1882
*Davis, F. W.	Adelaide	1882
*Dixon, Samuel	Adelaide	1887
Dobbie, A. W.	Adelaide	1876
Elder, Sir Thomas	Adelaide	1871
Eyres, Thos.	Adelaide	1887
Fleming, David	North Adelaide	1886
*Fletcher, Rev. W. R., M.A. ...	Kent Town	1876
Foote, H.	Outalpa	1883
Fowler, W.	Kulpara	1882
Gardner, Wm., M.D., C.M. ...	Adelaide	1882
Gill, H. P.	Adelaide	1883
Gill, Thomas	Adelaide	1885
Gosse, John, M.R.C.S.	Wallaroo	1884
*Goyder, Geo., jun.	Adelaide	1880
Grasby, W. C.	Adelaide	1887
Grundy, E. B.	Adelaide	1882
*Harris, C. H.	Adelaide	1883
Harrold, A. L.	Adelaide	1876
Hay, Hon. A., M.L.C.	Adelaide	1861
Henry, A , M.D.	Adelaide	1882
*Howchin, W., F.G.S.	Goodwood East	1883
Hughes, H. W.	Booyoolie	1883
*(F)Kay, R.	Adelaide	1853
Kelly, Rev. Robert	Mount Barker	1884
Knevett, S.	Adelaide	1878
*Lamb, Prof., M.A., F.R.S. ...	England	1883
*Laughton, E.	Adelaide	1874
Lendon, A. A., M.D.	Adelaide	1884
*Lloyd, J. S.	Adelaide	1856
Lower, O. B.	Parkside	1888
*Lucas, R. B.	Adelaide	1885
Magarey, A. T.	North Adelaide	1873
*Magarey, S. J., M.B.	Adelaide	1874
*Mayo, Geo., F.R.C.S.	Adelaide	1853
Mayo, G. G.	Adelaide	1874
Mestayer, R. L., F.R.M.S. ...	Sydney	1883
*Meyrick, E. T., B.A.	Sydney	1881
Middleton, W. J. E.	Upper Sturt	1882
Mitchell, J. T., M.D.	Port Adelaide	1885
Molineux, A.	Kent Town	1880
(L)Murray, Hon. David, M.L.C. ...	Adelaide	1859
Munton, H. S.	Adelaide	1884
*Parker, Thos.	Port Adelaide	1883
Phillips, W. H.	Adelaide	1883
Phillipson, W. T.	Adelaide	1887

Digitized by Google

Poole, W. B.	Adelaide	1886
Poulton, B., M.D.	Adelaide	1883
Reed, T. S.	Adelaide	1885
Robertson, R., F.F.P.S.	Adelaide	1882
*Rennie, Prof. E. H., D.Sc, F.C.S....	Adelaide	1885
Renner, F. E., M.D.	Carrieton	1885
Robins, A. F.	Adelaide	1887
Russell, William	Port Adelaide	1879
*Rutt, Walter, C.E.	Adelaide	1866
Salom, Hon. M., M.L.C.	Adelaide	1866
*Schomburgk, R., Ph.D.	Adelaide	1865
Scott, Jas. L.	Hyde Park	1865
*Smeaton, Thos. D.	Mount Barker	1857
Smith, R. Barr	Adelaide	1871
Smythe, J. T., B.A., B.E.... ...	Glenelg	1882
*Stirling, E. C., M.D., F.R.C.S., M.P.	Adelaide	1881
Stuckey, J. J., M.A.	Adelaide	1878
*Tate, Prof. R., F.G.S., F.L.S. ...	Adelaide	1876
*Thomas, J. D., M.D., F.R.C.S. ...	Adelaide	1877
*Tepper, J. G. O., F.L.S.	Norwood...	1878
*Todd, Charles, C.M.G., M.A., F.R.A.S.	Adelaide	1856
Tyas, J. W.	Adelaide	1882
Umbehaun, C., ...	Adelaide	1879
*Varley, A. K.	Mount Gambier	1883
*Verco, J. C., M.D., F.R.C.S. ...	Adelaide	1878
Vickery, G.	Meadows...	1868
Ware, W. L.	Adelaide	1878
Way, E. W., M.B.	Adelaide	1879
Way, S. J., Chief Justice	Adelaide	1859
Wheeler, F.	Freemantle, W. A. ...	1884
*Whittell, H., M.D., F.R.M.S. ...	Adelaide	1882
Wilson, John, F.E.T.S.	Goodwood	1887
*Wragge, C. L., F.R.G.S.	Brisbane	1887
*Zietz, A.	Adelaide	1886

ASSOCIATES.

Hodgson. Mrs.	Port Victor	1884

Digitized by Google

APPENDIX.

FIELD NATURALISTS' SECTION

OF THE

Royal Society of South Australia

REPORT OF COMMITTEE FOR YEAR 1887-8.

THE Section has now completed the fifth year of its existence, and continues to make satisfactory progress.

Excursions.—During the year 12 excursions have been held, most of which have been well attended. The year witnessed a new departure in regard to excursions. Previously no excursion occupying more than one day had been made, but during the past year a visit of three days' duration has been paid to Murray Bridge, and a trip by sea to Kangaroo Island and neighbourhood extending over a week.

Evening Meetings.—Seven evening meetings have been held, at which the attendance has been fairly good, but not so large as the Committee would like to see. An improvement has, however, been noticed in the number of exhibits brought to these meetings. Papers have been contributed by the following gentlemen:—Professor Tate, F.G.S., Messrs. J. G. O. Tepper, F.L.S., W. L. Cleland, M.B., A. Molineux, R. H. Pulleine, E. Guest, A. F. Robin, and W. B. Poole.

Show of Native Plants.—The Committee have devoted considerable attention to the show of native plants, &c., to take place next month (October). It has been decided to form a section of the show to be open only to members of the Boys' Field Club. Satisfactory arrangements have been made to hold the show in the Town Hall at the same time as that of the Horticultural and Floricultural Society.

Digitized by Google

Native Poisonous and Fodder Plants.—An attempt was made during the year to raise funds for valuable prizes of collections of native poisonous and fodder plants; but so little response was made to the appeal by pastoralists and others thought to be specially interested in the matter that the scheme was abandoned.

Protection of our Native Fauna and Flora.—An effort is now being made by the Section with a view to the better protection of our native fauna and flora, a portion of the scheme being that Government Farm should be vested in trustees as a National Park, where the above object may to some extent be accomplished.

Membership.—There has been a gratifying accession to the membership during the year—21 new members having joined, of whom nine are ladies. From resignations and other causes 14 names have been struck off. The number now on the roll is 114.

Financial.—The amount received from subscriptions during the year is £20, while the expenses have been £23 7s. 1d. It should be mentioned, however, that this year the Section has, for the first time, had to pay for printing its "Proceedings," this expense having previously been borne by the Royal Society. The subscriptions in arrear amount to £4 10s.

J. G. O. Tepper, Chairman.
W. H. Selway, Jun., Hon. Sec.

Digitized by Google

FIELD NATURALISTS' SECTION OF THE ROYAL SOCIETY OF SOUTH AUSTRALIA.

RECEIPTS AND EXPENDITURE FOR THE YEAR 1887-8.

DR. RECEIPTS.		CR. DISBURSEMENTS	
To Balance brought forward	£0 19 7	By Printing (General)	7 0 0
" Grant from Royal Society.. ..	25 0 0	" " (Proceedings)	4 5 0
" Amount received from Subscriptions	20 0 0	" Advertising	3 1 0
		" Postages and Sundries	7 17 1
		" Attendance (Caretaker)	1 4 0
			23 7 1
		" Subscriptions handed over to Hon. Sec. Royal Soc.	20 0 0
		" Balance in hand	2 12 6
	£45 19 7		£45 19 7

Audited and found correct,

THOS. EVANS,
J. H. C. LANGDON, } Auditors.

Adelaide, 18th September, 1888.

W. H. SELWAY, Jun., Hon. Sec.

Digitized by Google

MICROSCOPICAL SECTION

OF THE

Royal Society of South Australia.

ANNUAL REPORT, 1887-8.

In presenting their annual report the Committee regret to state that the attendance at the monthly meetings is still small, as only a few of the members evince any real interest in microscopical research, most of them using their microscopes only as a means of amusement or relaxation in their spare hours. Still, great interest has been taken in the meetings by those who attended, and it is felt that much information has been derived from the mutual discussions on the various subjects introduced, particularly as many of the members are beginners in the use of the microscope. It is much to be regretted that the medical men of Adelaide do not more warmly support the Section, as in most cities they form the bulk of the members of the microscopical societies, and are the most able and earnest workers,

The Committee regret to have to report the loss of one of its energetic members (Mr. R. L. Mestayer, F.R.M.S.), who has removed to Sydney. There have been also several other resignations through removal to the other colonies during the year. Amongst them we would mention Mr. H. C. Mais, late Engineer-in-Chief, who, on leaving, presented to the Section a valuable collection of microscopical magazines, bound and unbound, which will form the nucleus of a library.

Mr. Mestayer also presented us with his Beck's Students' Microscope for use at the meetings.

The number of members at the present time is 38. The average attendance during the year, at the monthly meetings, has been nine.

The subjects discussed at the meetings were as follows :—

Oct. 11. Exhibition of objects, including those from excursion.
Nov. 8. Polariscope apparatus, by Mr. F. S. Crawford.
Mar. 13. Grinding and mounting Echinus spines, by Mr. J. Colbourne.

Digitized by Google

Apr. 10. Gossip meeting.
May 8. Conversazione.
June 12. Freshwater polyzoa, by Mr. W. B. Poole.
July 10. Development of the tadpole, by Mr. D. Fleming.
Aug. 14. Diffraction spectra, by Dr. Whittell, F.R.M.S.

The conversazione was not such a success as in the past. The attendance of members was small, and the display of instruments anything but creditable to the Section. The annual address was given by the chairman (F. S. Crawford, Esq.), and amongst the exhibits of interest was a set of apochromatic objectives by Zeiss, made of the new optical glass, which under the able manipulation of Dr. Whittell proved their superiority to the old class of objectives, by even the best makers.

The circulation of the microscopical magazines and mounted objects amongst the members is still maintained, and it is hoped that we shall soon be in possession of a number of bound volumes in the library, which can be lent for reading at home.

The balance-sheet (appended) shows receipts £32 6s. 6d., and expenditure £25 12s. 6d., leaving a balance in hand of £6 14s.

F. S. Crawford, Chairman.
J. W. Bussell, Hon. Secretary.

Digitized by Google

Receipts and Expenditure for year ending 30th September, 1888.

Receipts.	£	s.	d.	Payments.	£	s.	d.
To Balance in hand 30th September, 1888—	0	1	6	By Magazines	0	17	6
" Members' Subscriptions	14	5	0	" Binding Magazines	1	8	0
" Grant from Royal Society	18	0	0	" Post Cards and printing same	1	2	0
				" Printing	1	17	6
				" Advertising	2	4	3
				" Postage	1	3	9
				" Stationery	0	1	0
				" Hire of Chairs for Conversazione	1	0	0
				" Caretaker, attendance	1	12	0
				" Royal Society, Subscriptions	14	6	6
					£25	12	6
				Cash in hand	6	14	0
	£32	6	6		£32	6	6

Examined and found correct.

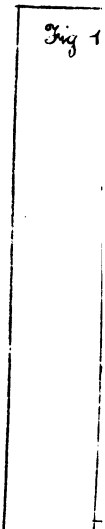
F. S. CRAWFORD, Chairman.
J. W. BUSSELL, Hon. Secretary.

J. G. ASHTON, Auditor.
September 11th, 1888.

Digitized by Google

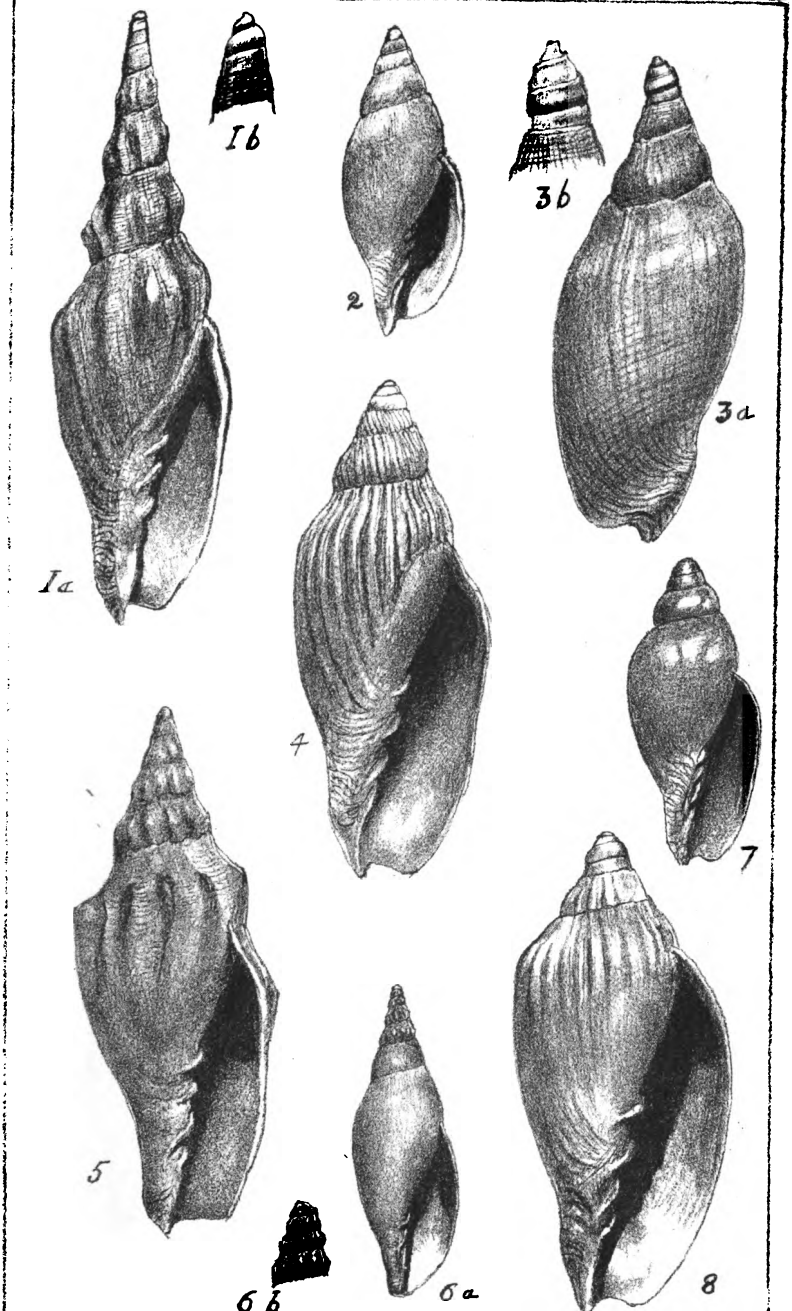
VARDON & PRITCHARD,
PRINTERS,
GRESHAM ST., ADELAIDE.

Digitized by Google



Digitized by Google

Digitized by Google

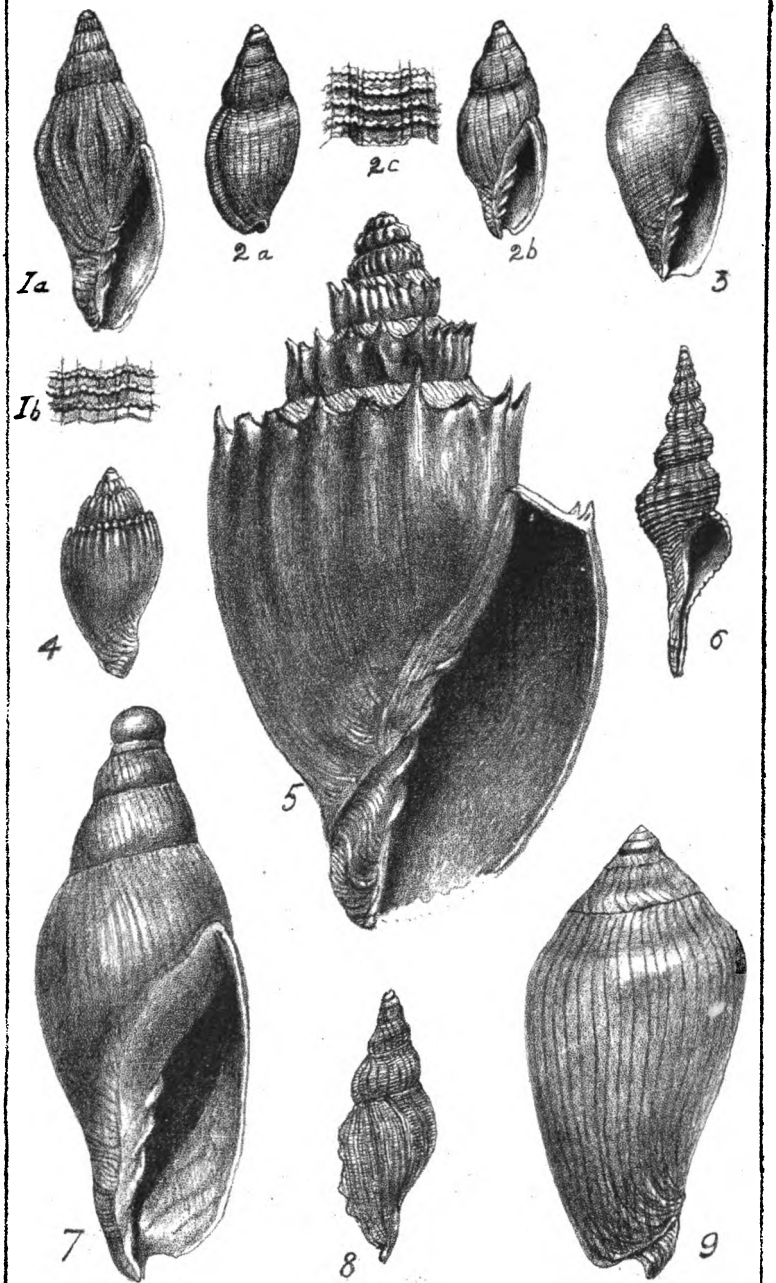


W.J.C

J.H. SHERRING & Co, LITHO

Digitized by Google

Digitized by Google

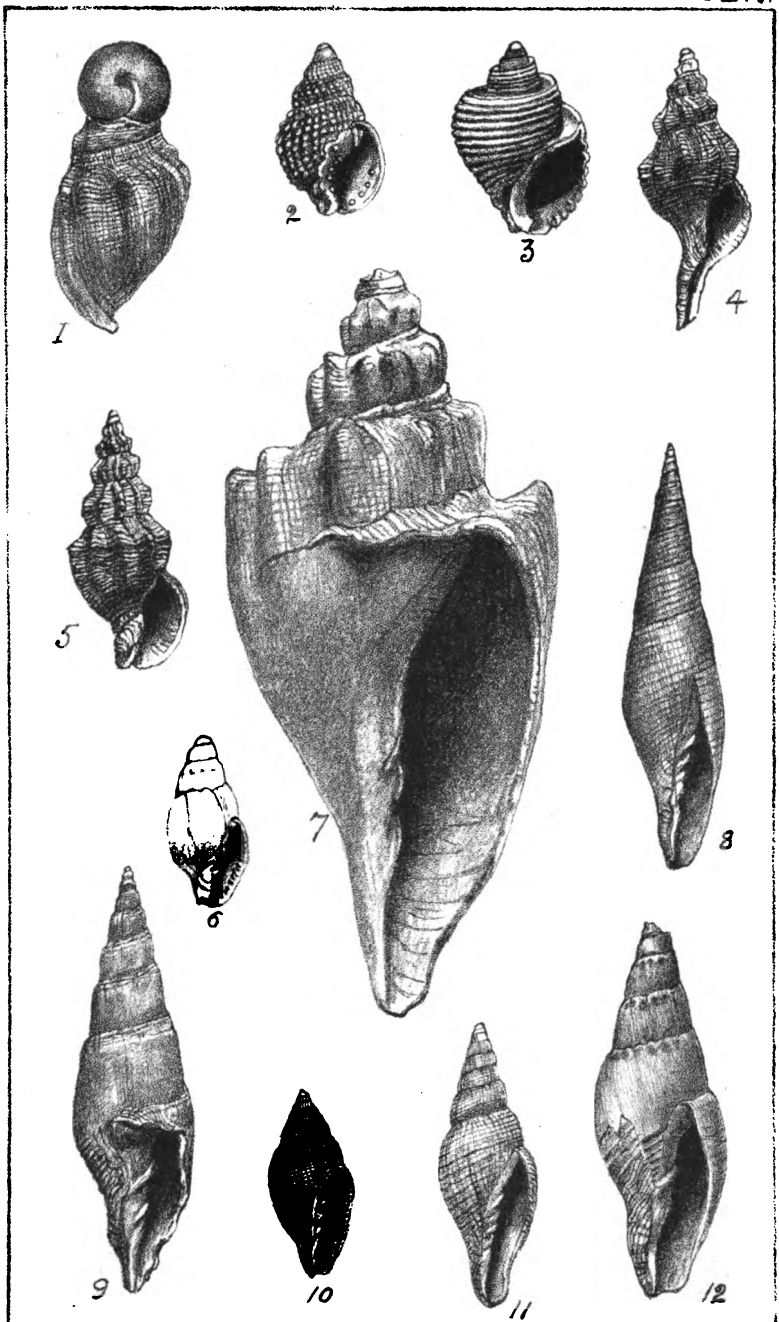


W.J.C.

J.H. SHERRING & Co, LITHO

Digitized by Google

Digitized by Google



W.J.C.

J. H. SHERRING & Co LITHO

Digitized by Google

Digitized by Google

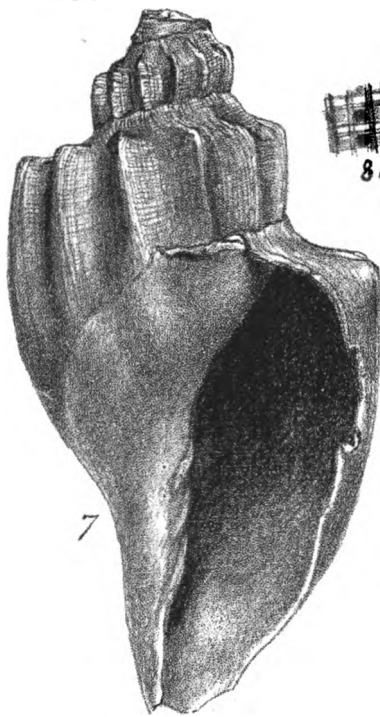
1

2

3

4

5


7

8b

8a

9

6

10

11

12

13

W.J.C.

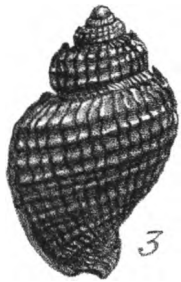
J.H. SHERRING & Co, LITHO.

Digitized by Google

Digitized by Google

1

2

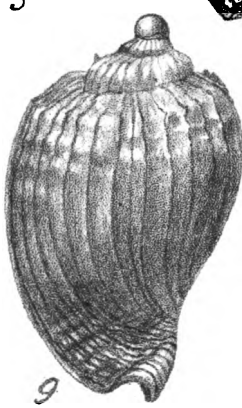

3

4

5

6

7


9

8

10

11

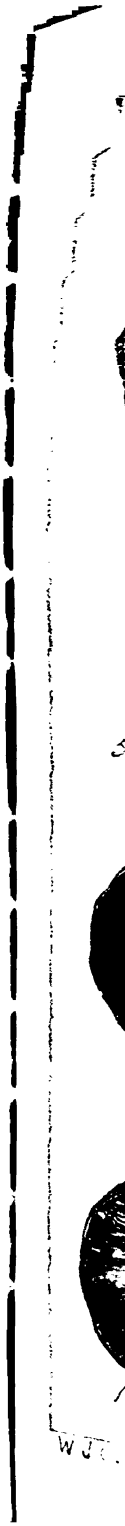
12

13

W.J.C.

J.H. SHERRING & Co, LITHO.

Digitized by Google



Digitized by Google

1

2

3

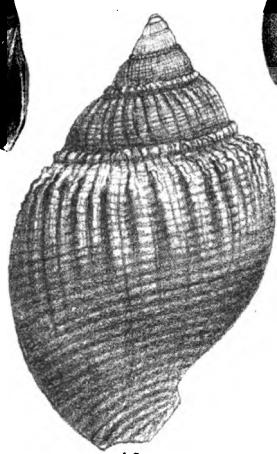
4

5

6

7

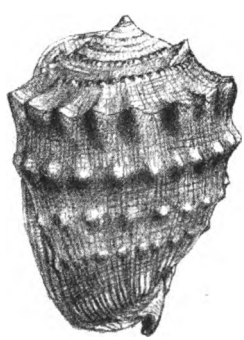
8


10

9

11

12


13

14

W. J. C.

J.H. SHERRING & Co, LITHO.

Digitized by Google

Digitized by Google

1

2

3

4

5

6

7b

7a

8

9

10

11

12

13

14

15b

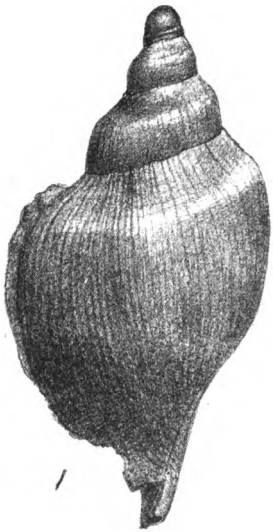
15a

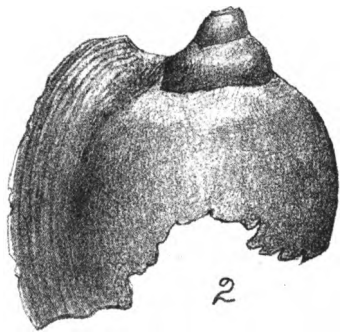
W.J.C.

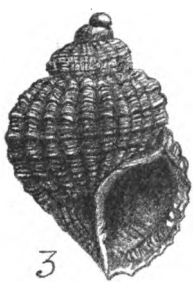
J. H. SHERRING & Co, LITHO.

Digitized by Google

Digitized by Google


1


2


3

4

5

6

7

8

9

10

11

W.J.C.

J.H. SHERRING & Co, LITHO

Digitized by Google

Digitized by Google

1

2a

2b

3

4

5

6

7a

7b

8

9

10

11

12

13

14

Digitized by Google

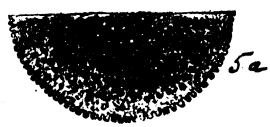
Digitized by Google

1

2

3

4


5a

5b

6

8

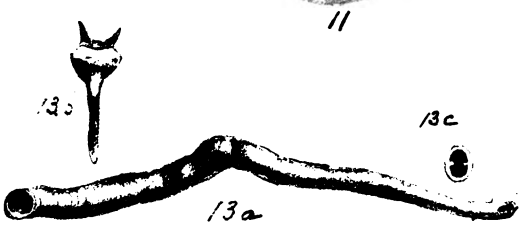
9

7

10

11

12


13b
13c
13a

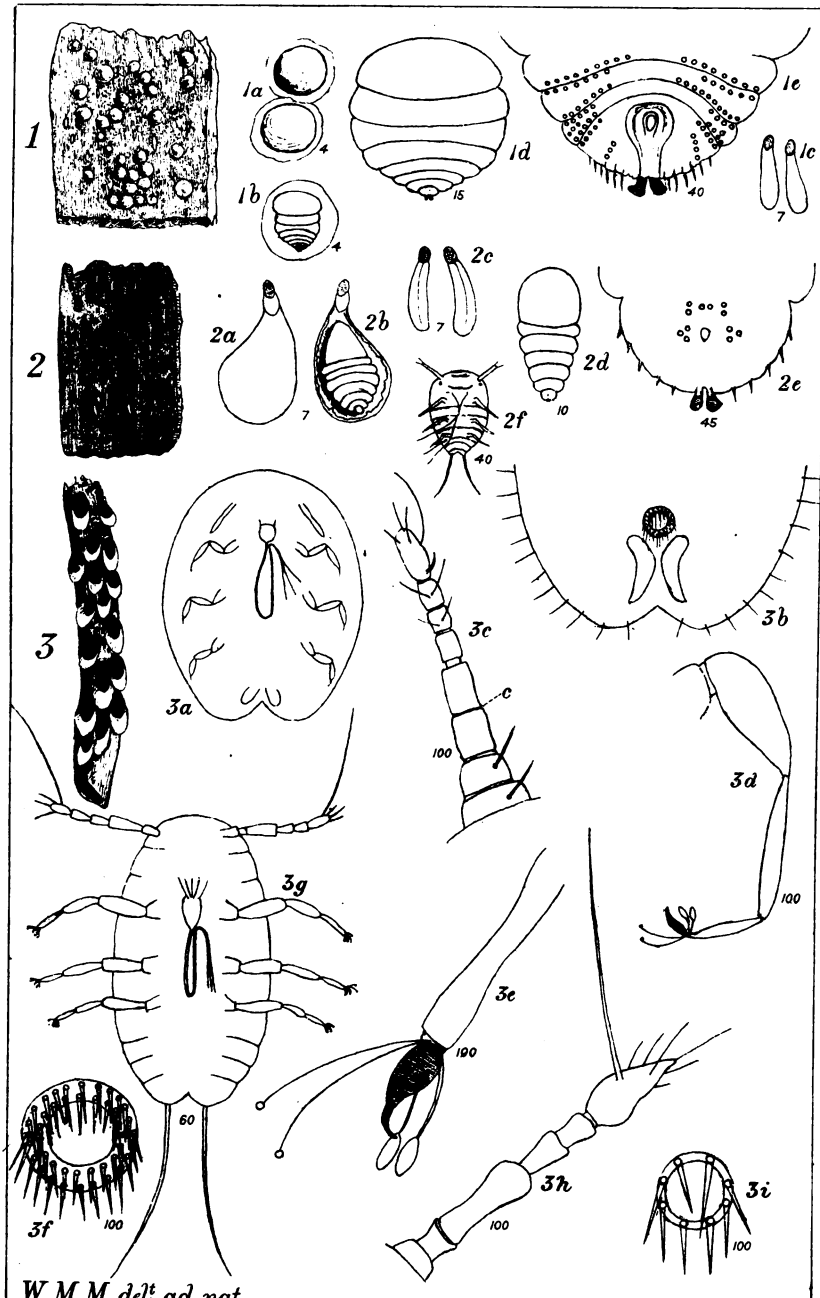
14

W & C.

J. H. HERRING & Co, LITHO.

Digitized by Google

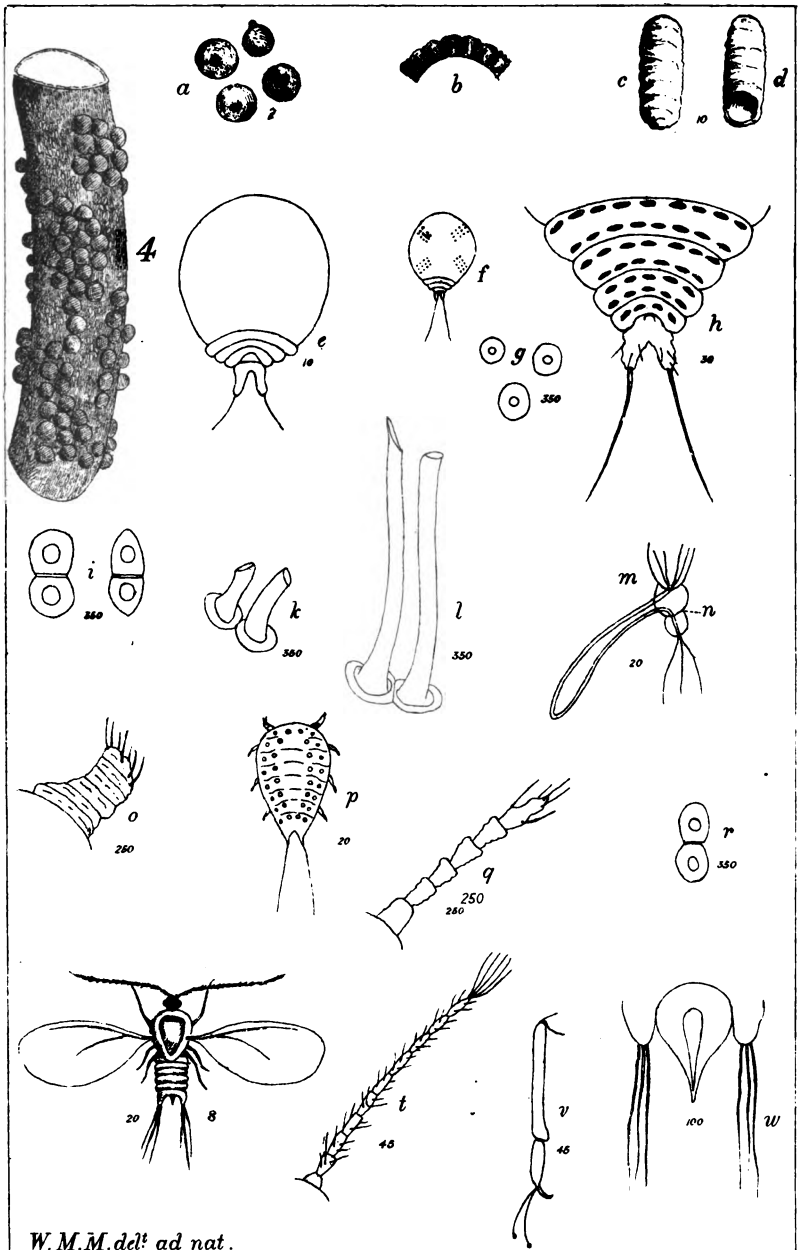
Digitized by Google



SURVEYOR GENERAL'S OFFICE, ADELAIDE. *Fraser S. Crawford. Photo-lithographer.*

Digitized by Google

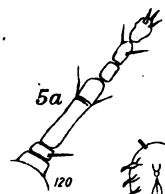
Digitized by Google

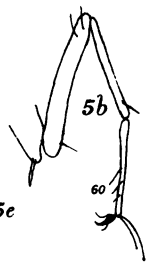


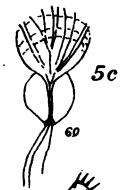
SURVEYOR GENERAL'S OFFICE, ADELAIDE. Fraser S. Crawford. Photo-lithographer.

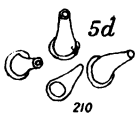
Digitized by Google

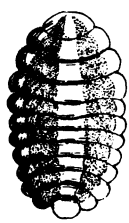
Digitized by Google

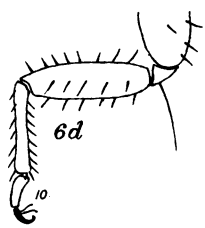


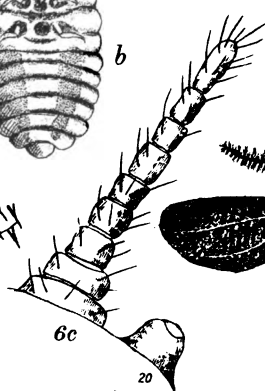


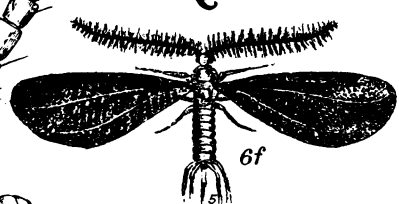


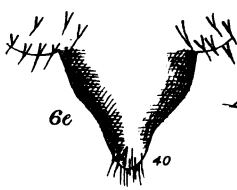


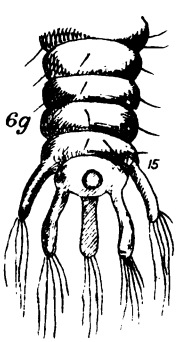


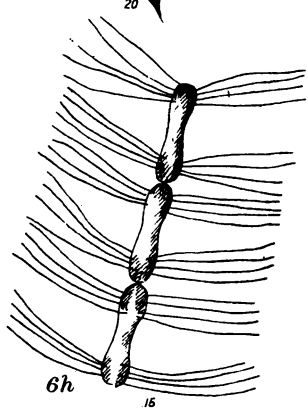


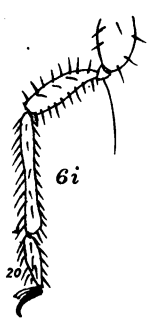












W.M.M del ad nat.

SURVEYOR GENERAL'S OFFICE, ADELAIDE. Frvizer S. Crawford., Photo-lithographer.

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

3 2044 106 281 454

Date Due

FEB 6 '67

Digitized by Google